FOOD TECHNOLOGY

PUBLISHED BY THE INSTITUTE OF FOOD TECHNOLOGISTS

IN THIS ISSUE

Guiding Principles for the Solution of Dietary Problems of an Aging Population / *271*

A Study of Methods of Testing and Sampling for the Determination of Fat Content of Ground Meat / *273*

Trends in the Development of Foods for the Upper-Age Groups / *277*

A Simple Bacteriological Medium for the Growth and Isolation of Spoilage Organisms from Canned Foods / *280*

Frozen Concentrated Citrus Juices — Co-Packer Quality Control / *281*

The Effect of Cathode Rays on Bacteria / *284*

Effect of Display Case Lighting on Color and Bacterial Growth on Packaged Fresh Beef / *290*

Flavor Studies of Canned Single Strength Orange Juice / *295*

Thermal Processes for Pimientos Canned in Glass Jars / *298*

The Control of *Tyrophagus lintneri* (Osb.) in Cured Hams / *300*

Hygroscopic Equilibria of Whole-Grain Edible Forms of Rice / *302*

Notes and Letters / *304*

Affairs of the Institute / *5*

Pages 271-306

June, 1954 Volume 8, Number 6

IMITATION
RASPBERRY
by FIRMENICH

FIRMENICH & CIE
SUCCESSEURS DE
CHUIT NAEF & CIE

FIRMENICH

WA
PAG

research reconstructed it in all its significant and desirable components. Firmenich Raspberry comes to you as a precise and potent flavor material of the utmost purity and stability to enhance the flavor of your products and to make them more attractive to your customers.

250 WEST 18th STREET, NEW YORK 11, N. Y.

CHICAGO OFFICE: 612 NORTH MICHIGAN AVE.
FIRMENICH OF CANADA, LIMITED, 348 WALLACE AVE. • TORONTO
GENEVA • PARIS • LONDON

ANSWERS TO YOUR QUESTIONS ABOUT ROCHE VITAMIN A

Q. *What is Roche vitamin A?*

A. It is vitamin A, the product of a synthesis which starts with Citral, from lemon grass oil. It is identical biologically with the vitamin A from other sources, such as fish livers. A Roche research team directed [illegible] this successful synthesis in 1947. This success- [illegible] of superb

AVY

iES

[illegible] A, Roche [illegible] referred for

[illegible] pharmaceutical [illegible] should be met

[illegible] ?

[illegible] laboratory [illegible] commercial [illegible] per gram, [illegible] A. It is a

[illegible] price, as [illegible] can mean [illegible] inventories [illegible] in 1950. Never before has the purchaser been assured of such low prices, consistent with quality and uniformity.

Q. *How is Roche vitamin A packed?*

A. All Roche vitamin A is packed under conditions which assure its stability in customary shipment and storage.

Q. *Can I get help from Roche in using vitamin A in my products?*

A. Yes, certainly! Roche technical experts who supplied so much data at the hearings for amended Definitions and Standards of Identity for Margarine are always at your service. It is important to you that Roche specializes in the manufacture of vitamins.

Q. *Is Roche vitamin A available in different types and potencies?*

A. It is. The following table shows the types most popular in food manufacturing.

TYPE	DESCRIPTION	POTENCY	ADDITIVE*
P1MO	Vitamin A palmitate	1,000,000 U.S.P. XIV units per gram	Edible oil only for standardization
P1.3	Vitamin A palmitate	Ranging between 1,250,000 and 1,500,000 U.S.P. XIV units per gram	None
A1MO	Vitamin A acetate	1,000,000 U.S.P. XIV units per gram	Edible oil only for standardization

*Antioxidants or other additives are included on customer's specifications.

Notes: Type P1MO has less tendency to crystallize during storage and handling than higher concentrations of vitamin A palmitate and acetate.

Type P1.3 is more susceptible to crystallization than type P1MO but can be handled without difficulty when using certain precautions.

Q. *Are special blends available for the margarine industry?*

A. Yes. Roche will supply blends to your specifications. A modern blending and canning plant is at your service.

Q. *What kind of service can I expect on special blends?*

A. The best—with special attention to accuracy, quality and control.

ROCHE

Vitamin A acetate and palmitate

Call Roche for vitamins

Vitamin Division

HOFFMANN-LA ROCHE INC.

Nutley 10, New Jersey • NUtley 2-5000

Pacific Coast: L. H. BUTCHER CO., San Francisco • Los Angeles
Seattle • Portland • Salt Lake City

In Canada: Hoffmann-La Roche Ltd.
286 St. Paul Street, West, Montreal, Quebec

IMITATION
RASPBERRY
by FIRMENICH

gives finer flavor...
greater sales appeal...
to your products

FIRMENICH & CIE
SUCCESSEURS DE
CHUIT NAEF & CIE

You get the direct and authentic reproduction of raspberries in their full perfection in Raspberry Flavor by Firmenich. For Firmenich took fully ripe raspberries, freshly severed from the stem, captured their delicate and fugitive flavor, and by original research reconstructed it in all its significant and desirable components. Firmenich Raspberry comes to you as a precise and potent flavor material of the utmost purity and stability to enhance the flavor of your products and to make them more attractive to your customers.

250 WEST 18th STREET, NEW YORK 11, N. Y.

CHICAGO OFFICE: 632 NORTH MICHIGAN AVE.
FIRMENICH OF CANADA, LIMITED, 348 WALLACE AVE. • TORONTO
GENEVA • PARIS • LONDON

ANSWERS TO YOUR QUESTIONS ABOUT ROCHE VITAMIN A

Q. *What is Roche vitamin A?*

A. It is vitamin A, the product of a synthesis which starts with Citral, from lemon grass oil. It is identical biologically with the vitamin A from other sources, such as fish livers. A Roche research team directed by Dr. Otto Isler announced their famous synthesis in 1947. This successful, economical process is now used to produce vitamin A of superb quality by the tons at Roche Park.

Q. *Does Roche vitamin A have a "fishy" odor or taste?*

A. None whatever, nor is there any "fishy burp." In fact, Roche vitamin A has almost no odor or taste and so is preferred for processed foods such as margarine.

Q. *Will I be able to get a steady supply of Roche vitamin A?*

A. You will. The entire commercial needs of the food and pharmaceutical industries of the United States and Canada could be met from our Nutley plant.

Q. *Can I be sure of a "standard" product?*

A. You can. Roche vitamin A is manufactured under strict laboratory control. It is more stable. It is uniform. The regular commercial types of Roche material, if diluted to 50,000 to 65,000 units per gram, will meet the specifications of U.S.P. XIV for oleovitamin A. It is a product of excellent quality.

Q. *What about price?*

A. Roche vitamin A is not subject to wide fluctuation of price, as has been true with vitamin A from natural sources. This can mean large savings for you as there is no need to carry large inventories as was the case prior to the introduction of Roche vitamin A in 1950. Never before has the purchaser been assured of such low prices, consistent with quality and uniformity.

Q. *How is Roche vitamin A packed?*

A. All Roche vitamin A is packed under conditions which assure its stability in customary shipment and storage.

Q. *Can I get help from Roche in using vitamin A in my products?*

A. Yes, certainly! Roche technical experts who supplied so much data at the hearings for amended Definitions and Standards of Identity for Margarine are always at your service. It is important to you that Roche specializes in the manufacture of vitamins.

Q. *Is Roche vitamin A available in different types and potencies?*

A. It is. The following table shows the types most popular in food manufacturing.

TYPE	DESCRIPTION	POTENCY	ADDITIVE*
P1MO	Vitamin A palmitate	1,000,000 U.S.P. XIV units per gram	Edible oil only for standardization
P1.3	Vitamin A palmitate	Ranging between 1,250,000 and 1,500,000 U.S.P. XIV units per gram	None
A1MO	Vitamin A acetate	1,000,000 U.S.P. XIV units per gram	Edible oil only for standardization

*Antioxidants or other additives are included on customer's specifications.

Notes: Type P1MO has less tendency to crystallize during storage and handling than higher concentrations of vitamin A palmitate and acetate.

Type P1.3 is more susceptible to crystallization than type P1MO but can be handled without difficulty when using certain precautions.

Q. *Are special blends available for the margarine industry?*

A. Yes. Roche will supply blends to your specifications. A modern blending and canning plant is at your service.

Q. *What kind of service can I expect on special blends?*

A. The best—with special attention to accuracy, quality and control.

ROCHE

Vitamin A acetate and palmitate

Call Roche for vitamins

Vitamin Division

HOFFMANN-LA ROCHE INC.

Nutley 10, New Jersey • NUtley 2-5000

Pacific Coast: L. H. BUTCHER CO., San Francisco • Los Angeles
Seattle • Portland • Salt Lake City

In Canada: Hoffmann-La Roche Ltd.
286 St. Paul Street, West, Montreal, Quebec

By serving today's housewife, this ad serves you!

The advertisement at the right will appear in beautiful full color in the June 14th issue of LIFE Magazine and in the June issues of *McCall's* and *Good Housekeeping.*

Like the others in this powerful series, this advertisement performs a real service for today's busy meal planner. By giving her appetizing, easy-to-follow recipes calling for many kinds of canned foods, it helps her in her never-ending quest for interesting, nutritious, economical meals for her hungry family.

And—by pointing out to millions of women everywhere the wide and wonderful variety of foods that come in cans, these ads help raise the prestige of all canned foods and beverages.

This is another example of Canco's efforts to help stimulate your sales—*to help you sell more in '54.*

Containers to help people live better

AMERICAN CAN COMPANY

CANCO

New York, Chicago, San Francisco; Hamilton, Canada

Give your cooking a Southern accent...serve

PLANTATION HAM DINNER

It's lots easier than it looks —with today's marvelous canned foods!

In the days of the Old South, a fancy, full-course meal like this took *hours* to put together.

Today, *you* can do it in minutes, because all the major ingredients come in cans—modern Canco cans, made by American Can Company.

Tender ham (no waste or shrinkage!), golden "sweets," garden spinach, citrus juices—for each of these (and hundreds of other products) American Can designs and makes a *perfect* can.

Take shrimp. Not too many years ago, no one knew how to pack them so they'd keep their luscious pink color and delicate taste. Canco experts solved the problem by inventing a special enamel lining for the cans—so today you get canned shrimp so good it's hard to tell them from fresh (except they're easier to serve, of course).

This is one of *many* ways that American Can Company helps you enjoy today's finest foods in their most convenient, thrifty form. Try the meal shown here. Give your guests a taste of Southern hospitality —the easy, modern way!

American Can Company

Containers to help people live better

The American Can Company not only makes containers for America's finest foods, it also helps develop canning processes that bring you these foods with full flavor and with even more vitamins than you often get in "fresh-bought" varieties.

The modern food can—perfected by Canco—made commercial canning of fruits and vegetables possible; revolutionized the grocery business; helped raise the national level of nutrition and health.

Through the years, constant Canco pioneering and cooperation with the canning industry have brought forth widespread process and product improvement—opening new markets for canned foods of all kinds.

SHRIMP COCKTAIL

Drain 1 can (5 oz.) shrimp; de-vein, if needed. Chill. Top with sauce made from 1 can (8 oz.) tomato sauce, 1 teaspoon horse-radish, ½ teaspoon sugar, ¼ teaspoon salt.

PLANTATION BAKED HAM

Remove 1- to 6-lb. ham from can. Place, fat side up, on rack in shallow baking pan. Combine ½ cup brown sugar and ½ cup honey; spoon over ham. Bake in slow oven (325°F.) 15 min. per lb., basting occasionally with pan drippings. Canned hams range from 1½ to 15¼ lbs.

SPICY CHERRY SAUCE

1½ tablespoons cornstarch
¼ cup sugar
¼ teaspoon allspice
¼ teaspoon ground cloves
1 can (1 lb. 0 oz.) red sour pitted cherries

Combine dry ingredients in small saucepan. Gradually stir in juice drained from cherries. Cook until thickened and clear, stirring constantly. Add cherries. Spoon over ham.

GLAZED SWEET POTATOES

Combine in medium frying pan ½ cup brown sugar, firmly packed, ½ cup water, 1 tablespoon butter or margarine, ½ teaspoon salt; simmer 5 min. Add 1 can (1 lb. 7 oz.) sweet potatoes. Simmer 10 min., turning potatoes often.

SPINACH SUPREME

Using sieve, drain liquid from 1 can (1 lb. 4 oz.) chopped spinach into saucepan. Boil quickly to reduce to about ½ cup. Add ¾ cup cream or evaporated milk, ½ teaspoon each salt and ground nutmeg, and spinach. Heat, stirring carefully. Serve with croutons browned in garlic butter.

HONEY-PECAN BISCUITS

Blend ⅓ cup honey and ½ teaspoon cinnamon; divide among 10 greased muffin cups. Put 3 canned pecan halves in each. Open 1 container refrigerated prepared biscuits; place one in each cup. Bake according to label directions.

LEMONADE CREAM SHERBET

1 envelope unflavored gelatin
½ cup cold water
1 can (6 oz.) frozen concentrated lemonade
2 cups milk
½ cup sugar
½ pt. heavy cream, whipped
Few drops yellow food coloring

Sprinkle gelatin over cold water; let stand 5 minutes to dissolve over boiling water. Combine thawed concentrate, milk, sugar and dissolved gelatin; beat well. Pour into refrigerator tray. Freeze until partially firm. Turn into chilled bowl; beat well. Add whipped cream and food coloring; beat well. Return to tray; freeze until firm, stirring occasionally. For other flavors, use frozen concentrated limeade, orange or pineapple juice.

GOOD HOT COFFEE

Brew it your favorite way—make it extra-good by using the full-flavored coffee you get in vacuum cans.

Three recipes serve 4. You may use can weights that vary slightly from those given here. Recipes were developed in Test Kitchens of the American Can Co.

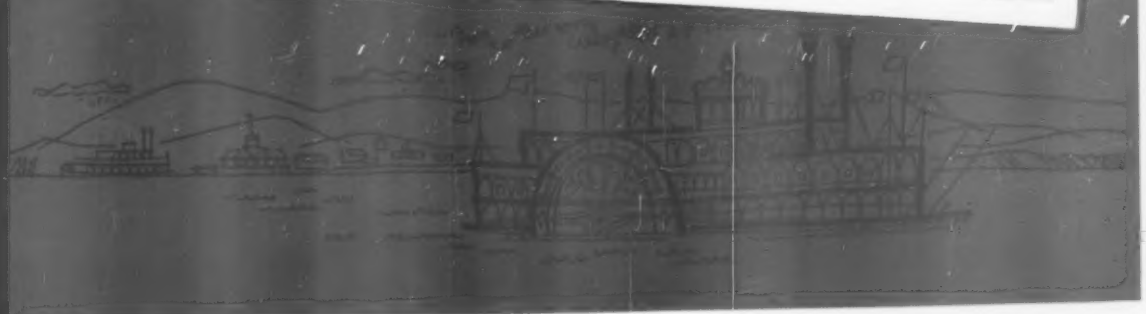
Important note. Whenever you do not use a full can of food . . . cover and keep the remainder in the refrigerator right in the can. It's safe—and it's sensible!

Now! Send for "Quick Trick Cookery"!

48 pages of menus, recipes, illustrated in color. Mail 15¢ to American Can Company Test Kitchens, Box 238, New York 46, N. Y., or in Canada, Box 130, Hamilton, Ont.

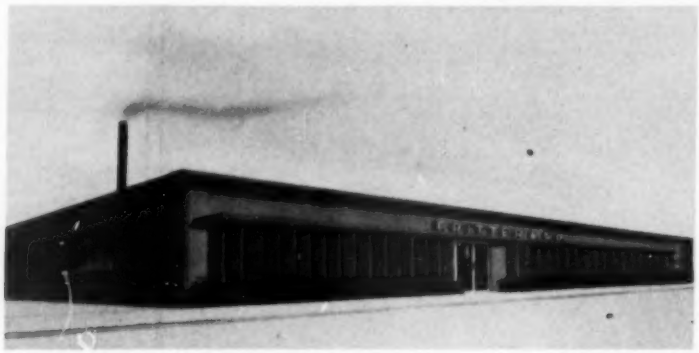
...an Can Company, N. Y., N. Y.

One of a series of favorite American meals brought to you by the American Can Company



F. RITTER & CO. of LOS ANGELES

Welcomes Food Technologists to



the National Convention at the Biltmore Hotel, June 27 to July 1st

Visit our booth No. 63 where you may register for the special tour of our plant. Tour leaves Biltmore Hotel 9 A.M. July 1st. Late **breakfast** will be served upon arrival at our plant.

See us in **action** at the Booth and at our Plant.

Dr. ALEXANDER KATZ & Co. ***Division of***

F. RITTER & CO.

Vancouver, B. C. **Montreal 1, P. Q.**

Dallas 1
Seattle 22
Pittsburgh 22
Atlanta 3

Los Angeles 39
New Orleans 13
Ogden, Utah
Denver 4
Mexico, D. F.

Minneapolis 5
San Francisco 3
Chicago 43
Portland 14

Affairs of the Institute

Committee in Charge of General Arrangements, Fourteenth Annual Meeting
Charles N. Frey—Today and Yesterday in the Life of the 1954 Appert Medalist
Recently Elected Members of IFT
Future Dates
Regional Section News
Books
Selected Abstracts
Food Industry Topics

Committees in Charge of General Arrangements Fourteenth Annual Meeting

Los Angeles, California

Planning, organizing, and administering an Annual Meeting require many minds and many hands. Inevitably, the brunt of the work falls on the host section and on a nucleus of hard-working, harried souls who have to attend to the innumerable details that accompany the major phases of the job; namely, arranging and following up on the general or over-all program, the program of technical papers, the exhibits, scheduling the meetings at the hotel and at other meeting places, registration, entertainment activities and the program for the ladies, publicity, banquets, printing, and hospitality. For their respective contributions in successfully bringing the 1954 Annual Meeting to its final stage, the congratulations and the appreciation of the Institute are due the following committees, their chairmen, and members:

General Chairman

MILTON E. POWELL, Knudsen Creamery Co.

National Program Committee

ARTHUR N. PRATER, *Chairman*
Gentry Division
Consolidated Foods Corp.
M. L. Anson, Lever Bros. Co.
F. E. Atkinson, Dominion Exp. Station
E. A. Beavans, U. S. Department of Agriculture
K. W. Brighton, American Can Co.
S. M. Cantor, Consultant
L. E. Clifcorn, Continental Can Company
G. A. Crapple, Wilson & Company
J. R. Esty, National Canners Association
E. Geiger, Van Camp Sea Food Co. & U. So. Calif.
D. B. Hand, New York Agr. Exp. Sta.
Marjorie Heid, Consultant
I. J. Hutchings, H. J. Heinz Company
W. R. Johnston, Consultant
H. R. Kraybill, American Meat Institute Foundation
E. E. Lockhart, Mass. Institute of Technology
A. C. Richardson, California Packing Corp.
W. R. Roy, Minute Maid Corp.
R. G. Tischer, Q. M. Food and Container Inst.
D. K. Tressler, Q. M. Food & Container Inst.
W. B. Van Arsdel, U. S. Department of Agriculture
R. H. Vaughn, University of California
R. H. Walters, General Foods Corporation

(Continued on page 8)

FOOD TECHNOLOGY

Published Monthly by the Institute of Food Technologists

Editor
MARTIN S. PETERSON
Editorial Office: 11606 South Bell Avenue, Chicago 43, Illinois

Consulting Editor
Z. I. KERTESZ

Editor Emeritus
C. OLIN BALL

Associate Editors

JOHN C. AYRES
ROBERT E. BUCK
HAROLD A. CAMPBELL
GEORGE A. CRAPPLE
WILLIAM B. ESSELEN, JR.
ROBERT E. FEENEY
DEAN FOSTER
SAMUEL A. GOLDBLITH
HELEN L. HANSON
WILLIAM R. JOHNSTON
C. HAMILTON KENNEY
AMIHUD KRAMER
HOWARD D. LIGHTBODY
WALTER A. MACLINN
R. E. MORSE
HUGH L. A. TARR
J. G. WOODROOF

ADMINISTRATIVE DATA AND DIRECTORY

Office of the Editor

11606 South Bell Avenue, Chicago 43

Address to this office all manuscripts, proofs, letters pertaining thereto, etc. Prospective contributors are invited to send for the pamphlet *Information and Suggestions to Authors* which contains style instructions.

Responsibility for statements appearing in FOOD TECHNOLOGY rests on the author thereof; points of view expressed in the columns of the journal do not necessarily have the indorsement of the Institute of Food Technologists. Mention of commercial products in the technical pages of this Journal is not to be construed as a recommendation of such products over others in the same category.

Business Manager

CHARLES S. LAWRENCE
176 West Adams Street, Chicago 3, Illinois

Address to the business office all requests for subscriptions, changes of address, and information on advertising. Claims for copies lost in the mails must be received 30 days after issue (90 days, foreign). Changes of address must be received at least two weeks before date of issue.

Subscription Rates: For members the cost of subscription is included in the annual dues. Non-members: domestic, $8.50 per year; foreign, $10.00 per year. Single and back copies: domestic, $1.00; foreign, $1.25.

Advertising Representatives: *Eastern:* Duncan Macpherson, 700 S. Washington Square, Philadelphia 6, Pa. *Midwestern:* Prendergast and Minahan, 168 N. Michigan Avenue, Chicago 1. *West Coast:* Duana Wanamaker, 610 S. Broadway, Los Angeles 14, California.

Publication Office

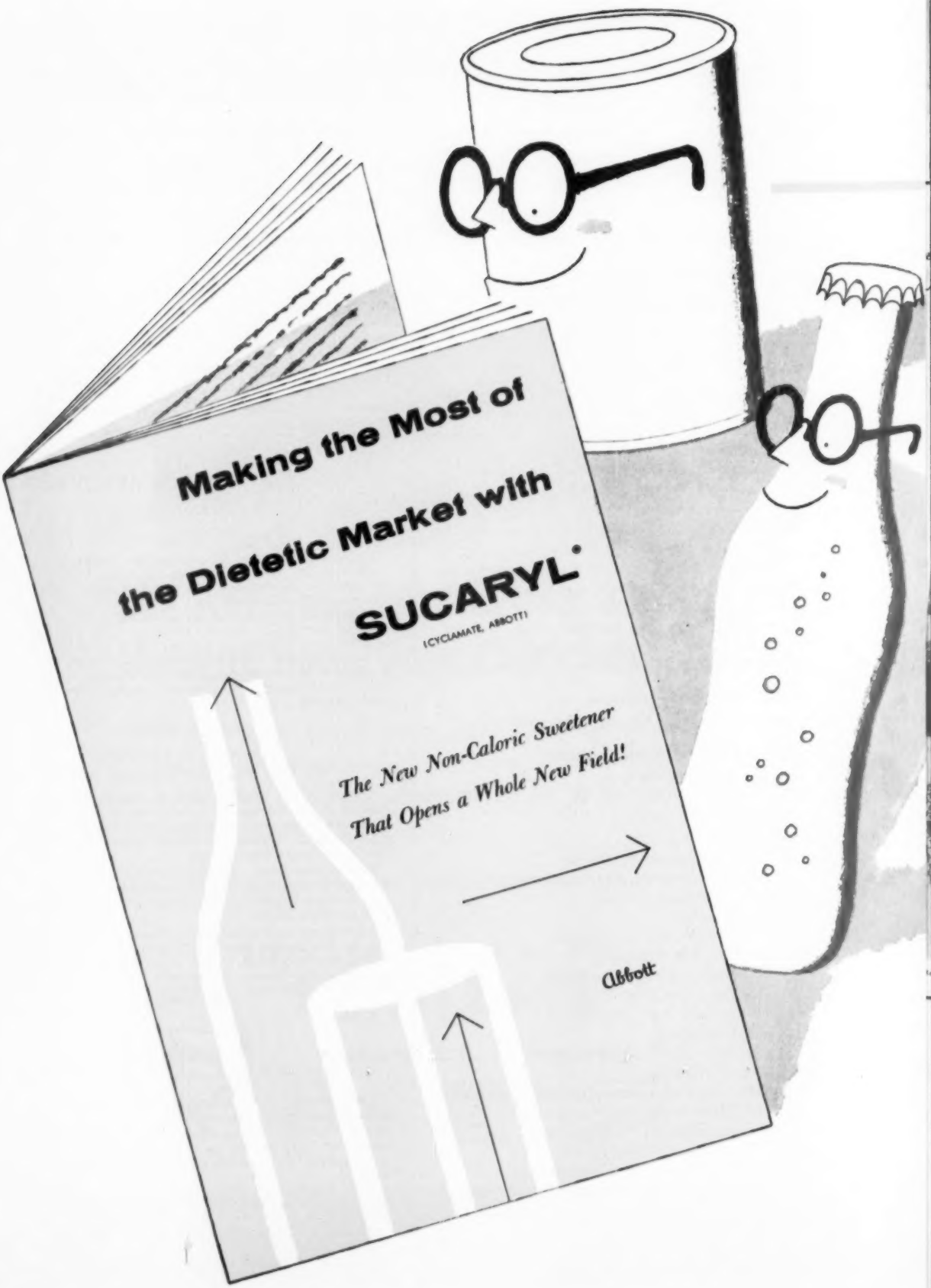
The Garrard Press,
119 West Park Avenue, Champaign, Illinois

Address to the Publication Office all requests for non-member subscriptions, back volumes, single copies (costs are listed above). Authors desiring reprints should address orders to this office; rates are printed on the order blank. (Requests for a single reprint of a published paper should be addressed to the author.)

FOOD TECHNOLOGY is published by the Institute of Food Technologists and printed by the Garrard Press, Champaign, Illinois, U. S. A.

Copyright, 1954, by the Institute of Food Technologists.

Mailing Permit: Entered as second-class matter, Feb. 25, 1947, at the Post Office at Champaign, Illinois, under the Act of August 24, 1912.


Making the Most of
the Dietetic Market with
SUCARYL®
(CYCLAMATE, ABBOTT)
The New Non-Caloric Sweetener
That Opens a Whole New Field!
Abbott

Got YOUR copy yet?

. . . it's yours for the asking!

Get the facts—*all of them*—about SUCARYL and the booming market for non-fattening soft drinks and foods! This new, informative booklet tells you how SUCARYL, the sensational non-caloric sweetener, can be used in your product . . . how SUCARYL will enable you to make the most of the fastest growing field in the beverage and food industries. It tells how SUCARYL was developed . . . how it was tested . . . plus all technical data! It's required reading for anyone who wants to know all the answers about the biggest business opportunity that's come along in years. If that means you, send for this free booklet today!

Abbott

MAIL THIS COUPON TODAY FOR YOUR FREE COPY!

Chemical Sales Division, Dept. FT
ABBOTT LABORATORIES
NORTH CHICAGO, ILLINOIS

Please rush a free copy of "*Making the Most of the Dietetic Market—with* SUCARYL" to:

FIRM: _____

STREET: _____

CITY: _____ ZONE____ STATE_____

ATT'N: _____

Why Myverol® Distilled Monoglycerides, Type 18-85, is a bargain

Myverol Distilled Monoglycerides, Type 18-85, is the stuff that has been doing such wonders in household and bakers' shortening.

Because it's doing so well, we've been able to do better, too. The price has been continually dropping and is now lower than ever. If you haven't checked it recently, you're in for a pleasant surprise.

Besides the price, there are a lot of reasons Myverol Distilled Monoglycerides, Type 18-85, is a bargain. It only takes a little to do the job you want—1.5% is plenty. You don't lose any, because its purity lets you add it after deodorization without any fear of affecting the color, odor, or flavor of your product.

When we make Myverol Distilled Monoglycerides, Type 18-85, we start in the usual way with a reaction mixture of glycerine and cottonseed oil. But then we do something unique by removing impurities and diglycerides through molecular distillation. The process works just as well with prime steam lard, soybean oil, or hydrogenated oils.

The best way to find out how much better Myverol Distilled Monoglycerides can make your product, how much less it costs, is to send for a free sample. Let us know enough about what you make so that we can select the best type of Myverol for you. ***Distillation Products Industries,*** Rochester 3, N. Y. Sales offices: New York and Chicago • W. M. Gillies and Company, Los Angeles and San Francisco • Charles Albert Smith Limited, Montreal and Toronto.

distillers of monoglycerides made from natural fats and oils

DPi Also . . . vitamins A and E

Distillation Products Industries
is a division of **Eastman Kodak Company**

COMMITTEES IN CHARGE OF GENERAL ARRANGEMENTS FOURTEENTH ANNUAL MEETING

(Continued from page 5)

Exhibits Committee

JOHN S. BECKETT, *Chairman*
Aseptic-Thermo Indicator Co.
William J. Marenus, Adolph's Food Products
Bromley M. Mayer, Knudsen Creamery Co.
Giriraj Rao, Mission Dry Corporation
Helen Forman, Knudsen Creamery Co.
Everett R. Wolford, U. S. Department of Agriculture
Leon S. Vodak, Knudsen Creamery Co.

Hotel Committee

MARSDON S. BURNS, *Chairman*
Calif. Vegetable Concentrates

Registration Committee

LOUIS B. ROCKLAND, *Chairman*
U. S. Department of Agriculture
Horace Campbell, Sunkist Growers, Inc.
S. T. Dulkin, Chem-Tech Labs.
Lloyd Fox, Exch. Orange Products
Wm. Kroehle, Mission Dry Corp.
O. E. Lobstein, Chem-Tech Labs.
Edward J. Mallen, Consultant
Charles V. Price II, Consultant
David E. Pritchett, Sunkist Growers
Randall G. Rice, U. S. Department of Agriculture
Marvin D. Ratner, Pacific Aromatics
James P. Ritch, Charles Pfizer & Co.
F. G. Stanford, Hyland-Stanford Corp.
J. Clyde Underwood, U. S. Department Agriculture

Arrangements Committee

RAYMOND E. COX, *Chairman*
Bireley's Div. General Foods Corp.
Bert Nielsen, Golden Citrus Juices
Jack Birds, Bireley's Div. General Foods Corp.
Reed Sutherland, Bireley's Div. General Foods Corp.
Fred Kleyn, Bireley's Div. General Foods Corp.
R. P. Miller, Exch. Orange Prod.
Geo. Bowen, Mission Dry Corp.
Dale Genung, Exch. Orange Prod.
Carl King, Nesbitt's
Roger Reid, Braun Corp.
Ed. Klein
Stanley Crouch, Fritzsche Bros.
Ted Smith, Dodge and Olcott
Hank Ospina, Bireley's Div. General Foods Corp.
Jim Turner, Atlas Powder Co.
W. C. Cole, Arden Farms Co.
Frances Volz, Knudsen Creamery Co.
G. M. Cole, Exch. Lemon Products
H. H. Holton, Exch. Lemon Products
O. K. Burman, Exch. Lemon Products
Harris Kieser, Exch. Lemon Products
Bert Brink, Exch. Lemon Products
G. H. Joseph, Sunkist Growers

Entertainment Committee

THEODORE B. AYRES, *Chairman*
American Can Co.
R. P. Ferren, American Can Co.

(Continued on page 12)

Notes from the makers of **Myvax Vitamin A**

What's the matter with vitamin A acid?

For food and pharmaceutical preparations, we offer Myvax Vitamin A Acetate or Palmitate. We know exactly what it is and a great deal about what it does and why. So do our customers.

For a puzzle, we recommend vitamin A acid. Very little is known about its biochemistry. This much we know: Vitamin A acid appears to have about the same potency as vitamin A when bioassayed by the rat growth method. The rat grows all right, but you can't find the vitamin A in him. No matter how much you give him, he doesn't deposit any perceptible amounts either as the acid or as vitamin A in his tissues or organs. This makes vitamin A acid unique, since other vitamin-A-active compounds, including carotenoids, are deposited in substantial quantities as vitamin A in the various tissues.

It doesn't look as if vitamin A acid will ever become important to the food or pharmaceutical businesses. But who knows? Someday a customer may call up and want to know something about it. We want to be able to supply helpful information as well as Myvax Vitamin A and Myvapack Vitamin A. Both the information and the vitamins are available from stock. ***Distillation Products Industries,*** Rochester 3, N. Y. Sales offices: New York and Chicago • Charles Albert Smith Limited, Montreal and Toronto • W. M. Gillies and Company, Los Angeles and San Francisco.

"Myvax" and "Myvapack" are trade-marks.

leaders in research and production of vitamin A

DPi

Also . . . vitamin E . . . distilled monoglycerides . . . more than 3500 Eastman Organic Chemicals for science and industry

Distillation Products Industries *is a division of* **Eastman Kodak Company**

Charles N. Frey—Today and Yesterday in the Life of the 1954 Appert Medalist

While possibly appropriate in Scarsdale (New York), it is doubtful that Dr. Charles N. Frey will consider wearing his Tyrollian hat, old fashioned knickers, and carrying his Irish walking stick when he is presented with the Nicholas Appert Award. But this is one of the many "yesterdays" of interest in the life of the 1954 Medalist. The presentation will be made by Stanley F. Brockington, Chairman of the Chicago Section, during the annual meeting of IFT at Los Angeles.

For the most part we will deal here with Dr. Frey as a person. "Mr. Yeast's" accomplishments in the field of food technology are already well known (the vitamins; B_1 in yeast fermentation; vitamin D from yeast; action of proteolytic enzymes, etc., etc.). After communicating with many of his close friends, we found he is a "truly lovable character," with a tremendous fund of scientific knowledge (begun but not ended at the University of Wisconsin—Ph.D., 1919). While he is "ordinarily dependable to an unusual degree, this reliability ceases when he discusses his flowers or his golf score." During World War I he was a captain in the Sanitary Corps; he trained for overseas duty at Camp Custer. It was here that he met, wooed and won a young bacteriologist, named Miss Julia Leary. In their early years of marriage they lived in the home of Professor H. S. Scribner, head of the Greek Department at the University of Pittsburg. This served to further an interest Dr. Frey has had in Greek History and Greek Philosophy since he was a boy of twelve. This interest in the ideas and in the achievements of one of the world's most profound civilizations he still has.

Golf is one of his favorite hobbies, especially when wearing a "vest with his watch chain and keys exposed." He also enjoys fishing with his friends who talk science while waiting for the fish to make up their minds about the "snack" dangled before their eyes. His friends look forward to his guided tours through Westchester County during which he points out the numerous historical Revolutionary War locations—a veritable laboratory of one of our nation's yesterdays.

Dr. Frey has always been a true supporter of civic and educational activities, especially those institutions and organizations that have to do with food science and the health and welfare of man (IFT, Association of Cereal Chemists, National Research Council, Food and Nutrition Board, New York Academy of Sciences, etc., etc.). At the University of Wisconsin he helped in organizing a chapter of Phi Sigma, an honorary biological fraternity. More recently, he has been a trustee of the N. Y. Chemists Club. Other posts are too numerous to mention here.

Charley's ambition is to keep busy and continue to make contributions in the line in which he is qualified. His thinking is constantly applied toward scientific knowledge for the betterment of mankind. An inherent interest in young men — scientifically bent — who need encouragement and direction, marks him as a leader of men. He is a deep thinker and a wonderful teacher (University of Wisconsin faculty, 1916-17; Mellon Institute, 1920-22; Gordon Research Conferences, since their founding; Massachusetts Institute of Technology, currently as special lecturer). Even as a young man he could discuss controversial matters with an open mind and an even temper. He can disagree most decidedly and still be "considerate, fair, and kindly." He gets quite indignant over matters where he feels someone is not getting a square deal and he always tries to do something about it.

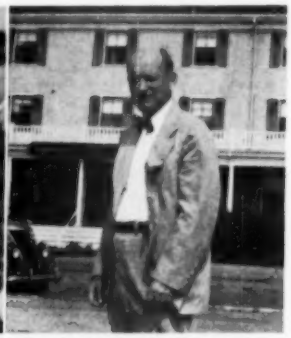
It was of such men and women as Frey that Kipling wrote the following lines:

When earth's last picture is painted
And the tubes are twisted and dried,
When the oldest colors have faded and the youngest critic has died,
We shall rest, and faith we shall need it,
Lie down for an eon or two,
Till the Master of all good workmen shall put us to work anew.

SOME YESTERDAYS

Charles N. Frey at the beginning of his career.

Julia and Charles Frey in the 'Twenties.



Wood's Hole—in the 'Forties

SOME INTERESTS

AMERICAN HISTORY
With his daughter Florena at old Fort Ticonderoga.

FLORISTRY
Against a background of plants and flowers.

Pick the Purchasing Agents who do business with *Sterwin*

Many P.A.'s (and other busy execs.) are sleeping better, smiling oftener because Sterwin delivers the products they want, when they want them, where they want them. Quick delivery from branches in 10 cities covering the United States and Canada.

BRANCH OFFICES & STOCKS CARRIED AT:
Atlanta, Buffalo, Dallas, Evanston, Ill., Kansas City, Mo., Los Angeles, Portland, Ore., San Francisco.
IN CANADA: Montreal, Toronto.

Sterwin Chemicals INC.
Subsidiary of Sterling Drug Inc.
1450 BROADWAY, N. Y. 18, N. Y.

Vitamins, U.S.P.—Zimco® Vanillin, U.S.P.—Parakeet® Certified Food Colors—Enrichment Concentrates—Roccal® Sanitizing Agent—Flour Maturing, Bleaching, Enrichment.

COMMITTEES IN CHARGE OF GENERAL ARRANGEMENTS FOURTEENTH ANNUAL MEETING

(Continued from page 8)

N. A. Eastwood, Laura Scudder Food Products
Robert Pedersen, Starkist Foods
E. J. Draper, Treesweet Products

Ladies' Entertainment Committee

MARJORIE HEID, *Chairman*
Consultant
Mrs. Philip K. Bates
Mrs. Willard E. Baier
Mrs. Raymond E. Cox
Mrs. Harry J. Deuel, Jr.
Mrs. John W. Koehler
Mrs. J. Raymond Lindquist
Mrs. Gordon L. Merchant
Mrs Milton E. Powell
Mrs. Arthur N. Prater

Publicity Committee

J. RAYMOND LINDQUIST, *Chairman*
Rexall Drug Co.
Rolly Langley, Rolly Langley Prodns.
Otto E. Lobstein, Chem-Tech Labs.
James P. Ritch, Chas. Pfizer & Co.
R. Rodriguez, Western Canner & Packer
Peter J. Stupin, Calavo, Inc.
E. W. Thurston, Jr., Thurston Labs.

Banquets Committee

WILLARD E. BAIER, *Chairman*
Sunkist Growers, Inc.
Steve Poulsen, Sunkist Growers
L. P. Gerber, Arden Farms Co.

Printing Committee

JOHN W. KOEHLER, *Chairman*
Pfaudler Sales Co.

Finance Committee

ROBERT N. BRAINERD, *Chairman*
Moorhead & Co.
E. A. Beavens, U. S. Department of Agriculture
J. S. Lawless, Frosted Fruit Products

Hospitality Committee

GORDON L. MERCHANT, *Chairman*
Merck & Co.
LeRoy Alfreds, Griffith Labs.
Rosslyn B. Alfin-Slater, Univ. So. Calif.
Sara W. Blangsted, Mission Dry Corp.
Sam S. Carlat, Sterol Derivatives
C. Galiagher, Sunkist Growers
E. A. Hawkes, Hyland-Stanford Corp.
Rufus Horne, Hyland-Stanford Corp.
F. B. McKenzie, Albers Milling
Robert W. Mojonnier, Mojonnier Bros. Co.
Margaret G. Morehouse, Univ. of So. Calif.
Frank Perrin, Continental Can Co.
Edward L. Peterson, Felton Chemical Co.
Milton E. Ziebarth, Hyland-Stanford Corp.
Hans A. Zullig, Real Gold Citrus

Recently Elected Members of IFT

Charles A. Baker
Penniman & Browne, Inc.
341 St. Paul Pl.
Baltimore 2, Md.

John F. Bozman
469 Boulevard Dr.
Decatur, Ga.

Fred I. Breck, Jr.
304 Howard St., S. E.
Atlanta, Ga.

William H. Butz
6114 Ensign Ave.
No. Hollywood, Calif.

Manuel D. Cabarcos
Continental Can Corp.
Suarez & Perkins, Luyano
Havana, Cuba

David L. Carpenter
Pillsbury Mills, Inc. Res. Labs.
208 Third Ave., S. E.
Minneapolis 14, Minn.

C. Reynolds Clark
Georgia Dept. of Agri.
Chem. Div.
254 Capitol Place, S. W.
Atlanta 3, Ga.

Walter R. Frederick
9351 Sioux Ave., Redford Twnsp.
Detroit 28, Mich.

Frederick J. Goetze
605 S. Caroline St.
Baltimore 31, Md.

Dr. Paul L. Harding
Marketing Research Div., AMS
2120 Camden Road
Orlando, Fla.

William J. Hoover
200 Midland Bldg.
Colorado Springs, Colo.

Robert E. Horrobin
Firmenich & Co.
612 N. Michigan Ave.
Chicago 11, Ill.

J. L. Katz
Imperial Sugar Co.
Sugar Land, Tex.

George C. Kingston
Frank M. Wilson Co., Inc.
Waterloo & Harding Way
Stockton, Calif.

Beverley J. Layman
1742 W. 34th St.
Chicago 8, Ill.

Edmund Moulton
520 E. Shore Highway
Albany 6, Calif.

Dr. K. L. Narasimham
Gerber Products Co.
Fremont, Mich.

Edward A. Poleselli
935 So. Humboldt St.
San Mateo, Calif.

Michael Z. Salovesh
5532 South Shore Dr.
Chicago 37, Ill.

Ralph R. Smith
Crown Can Co., Res. Dept.
Orlando, Fla.

Leon S. Vodak
Knudsen Creamery Co.
Santee St. at 21st
Los Angeles 54, Calif.

Margaret E. Beale
1A Princes Highway
Kogarah, N. S. W. Australia

Vivian B. Biske
American Can Co. Res. Dept.
11th and St. Charles Rd.
Maywood, Ill.

Dr. J. Robert Brunner
Michigan State College
Sch. of Agri. Dairy Dept.
East Lansing, Mich.

Marvin A. Coontz
E. J. Kelly & Assoc.
3521 Union Pacific Ave.
Los Angeles, Calif.

John G. Donnellan
65 Boorara Ave.
Oatley, N. S. W. Australia

John R. Gatenby
19 Grandview Poe
Epping, N. S. W. Australia

Dr. Wendell H. Griffith
Dept. of Physiological Chem.
Univ. of Calif. Medical Ctr.
Los Angeles 24, Calif.

Dr. C. A. Iverson
Iowa State College
Dairy Industry Dept.
Ames, Iowa

Dorothy A. Jones
10404 S. Stamps Rd.
Downey, Calif.

Robert C. O'Connor
M. A. Gedney Co.
Lowry Ave. No. and River
Minneapolis 11, Minn.

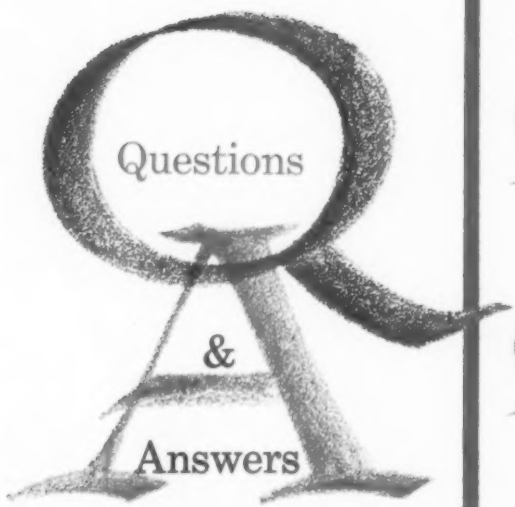
Peter M. Racklyeft
Gordon Edgell & Sons Ltd.
P. O. Box 56
Bathurst, N. S. W.
Australia

Philip J. Reiner
1459 Western Ave.
Glendale 1, Calif.

Clement C. Schmiege
1165 Oakwood Ave.
Des Plaines, Ill.

Henry G. Springer Jr.
6454 So. Whipple St.
Chicago 29, Ill.

(Continued on page 14)



ON PY-RAN

Q **What is PY-RAN?**

PY-RAN is the new, coated, anhydrous monocalcium phosphate leavening agent just put on the market by Monsanto.

Q **Just what is meant by "coated?"**

Each granule of PY-RAN has a moisture-absorbent covering which protects it against premature reaction during storage or shelf life.

Q **What can PY-RAN do for me?**

Give you leavening *stability* never before possible.

Q **How will this stability affect the shelf life of my products?**

Aging tests conclusively prove PY-RAN's superior stability increases the life of prepared mixes and self-rising flour. The special coating retards premature reaction. Deteriorated, returned goods are reduced to a minimum.

Q **How will this greater stability affect the release of CO_2?**

Greater stability of PY-RAN assures a controlled release of gas, even after long storage. Tests clearly prove PY-RAN releases CO_2 slowly during first two minutes of the mixing of the dough or batter. This two-minute reading is especially important, as any CO_2 evolved during this time will be unavailable for leavening action in the oven.

Q **What other advantages has PY-RAN?**

Slow, controlled release of gas as produced by PY-RAN gives excellent texture, volume and crust and crumb color. Tunneling is virtually eliminated.

Q **Can PY-RAN be used in conjunction with other phosphate leavening agents?**

Yes. PY-RAN will blend perfectly with other leavening phosphates such as Monsanto SAPP and HT phosphates.

Q **How can I find out more about PY-RAN?**

We will be glad to furnish you samples so you can see for yourself what it will do. In addition, our completely equipped food laboratory is ready to work with you to show you the best way to use PY-RAN and other of the Monsanto leavening phosphates for maximum results. For more information or a copy of the new booklet, "MONSANTO PHOSPHATE LEAVENING AGENTS," write to
MONSANTO CHEMICAL COMPANY,
Inorganic Chemicals Division,
1700 South Second Street, St. Louis 4, Missouri.

PY-RAN: Reg. U. S. Pat. Off.

Other Members of Monsanto's Leavening Family

MONSANTO
SERVING INDUSTRY... WHICH SERVES MANKIND

Monsanto SAPP-40 ... ideal for machine doughnut mixes

Monsanto SAPP-28 ... a slow-action baking acid

Monsanto HT Phosphate ... MCP monohydrate: use it alone or with other mixes for good results.

Recently Elected Members of IFT

(Continued from page 12)

Dr. Robert J. Sumner
Anheuser-Busch, Inc.
Central Research Dept.
St. Louis 18, Mo.

Edwin Traisman
R. 1—Box 63
Des Plaines, Ill.

STUDENTS

Toshio Kawatomari
Univ. of Calif.—121 Hughes Hall
Davis, Calif.

Henry P. Meloche, Jr.
323 Ann Street
E. Lansing, Mich.

Jagdish C. Anand
C.S.I.R.O., Div. of Food Pres.
Private Bag, P. O.
Homebush, N. S. W.
Australia

Donald Jarman
James Stedman Henderson Sweets Ltd.
P. O. Box 66
Haymarket, N. S. W.
Australia

Alex S. Malaspina
Mass. Inst. of Tech.
Graduate Hse
Cambridge 39, Mass.

Abdul R. A. Rahman
Dept. of Food Tech
Oregon State College
Corvallis, Ore.

Charles A. Ready
Box 285 Campus Station
Univ. of Georgia
Athens, Ga.

Ali Touba
Food Tech. Dept. 219 ASL
Univ. of Illinois
Urbana, Ill.

THE MONSANTO PRESENTATION AWARD—AN IFT ANNUAL MEETING FEATURE

At Los Angeles in late June the winner of The Monsanto Presentation Award, the honorarium for which has been increased to $200.00 will once again be selected. The Award is given annually to the author of the outstanding annual meeting paper. Effective organization, clarity and accuracy of content, effective verbal and visual presentation—these are some of the criteria on which papers and speakers are judged. Since the founding of the Award in 1952, Dr. Richard Forsythe (then of Swift & Company) and Dr. S. A. Goldblith (Massachusetts Institute of Technology) have been the awardees. Dr. C. Olin Ball, Monsanto Presentation Award Chairman, with characteristic thoroughness and statistical acumen, has once again organized the judging team and as in the past the meetings will be completely monitored in order that the most distinguished presentation may be determined. Announcement of the winner will be made in a summer issue of FOOD TECHNOLOGY.

FUTURE DATES FOR FOOD TECHNOLOGISTS

1954

June 23-25	Seventh Annual Meeting of the Research and Development Associates, Food and Container Institute, Los Angeles, California
June 27 to July 1, 1954	**Fourteenth Annual Meeting of the Institute of Food Technologists, Los Angeles, California**
August 9-13	Gordon Research Conferences, AAAS, *Food and Nutrition Sessions*, Colby Junior College, New London, N. H.
August 16-20	*Vitamins and Metabolism Sessions*, Colby Junior College, New London, N. H.
September 12-17	One hundred and twenty-sixth National Meeting of the American Chemical Society, New York, N. Y.

(Information concerning future dates of national and international meetings, conventions and exhibits of interest to food technologists should be sent to the editorial office.)

Regional Section News

AUSTRALIAN SOUTHERN SECTION

The *Proceedings of the Third Annual Convention* of the Institute of Food Technologists (1953) Australian Regional Section has been out for some time but has perhaps not been brought to the attention of readers overseas. A limited number of copies is available for distribution through Mr. Kevin B. Smith, Treasurer, IFT, Australian Southern Section, Care of Southern Can Co. (Aust.) Pty., 240 Geelong Road, West Footscray, Victoria, Australia. News of the Fourth Annual Meeting (Dr. V. M. Lewis, Convenor) will be forthcoming at an early date. The meeting, a most successful one, was held during May with the Australian Northern Section as host.

MARYLAND SECTION

Forty-six members and guests were present at the April meeting of the Maryland Section, which was held at the Baltimore Plant of the American Sugar Refining Company, on Friday, April 9, 1954.

The meeting started with a conducted tour of the refinery and then a short break for dinner. After a delightful repast, the movie "Crystal of Energy" was shown and Dr. Dorr Tippens of the plant staff gave a thorough explanation of the sugar refining process. Since most members of the Section use sugar in their professional lives, Dr. Tippens' remarks sparked a lively question-and-answer period.

The Section reluctantly bid farewell to its present chairman, Dr. Arthur Kaplan, who is being transferred out of the area. Dr. Kaplan, who is in charge of Germicides and Fungicides for the Quartermaster Corps, Department of the Army, is being transferred to the new Quartermaster Research Center in Natick, Massachusetts.

Mr. Leroy Strasburger was appointed Acting Chairman of the Maryland Section to fill out Dr. Kaplan's unexpired term.

WESTERN NEW YORK SECTION

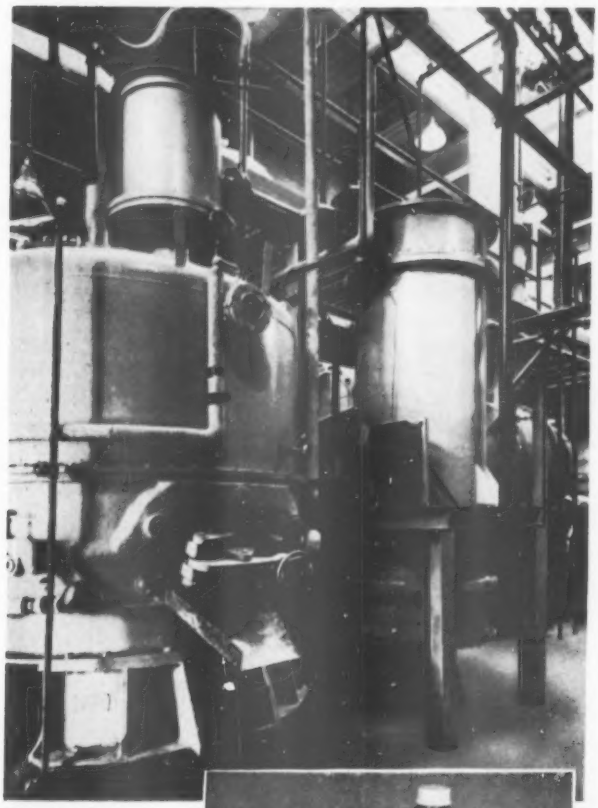
Mr. Tom Chapman, Technical Sales Service, Seaplant Chemical Corporation, addressed the Section's Buffalo Chapter on April 26, speaking on "the ever increasing importance of seaweed extractives in the food industry." The dinner meeting was held in the Erie County Technical Institute, Buffalo, N. Y. In view of the increasingly important role of these extractives in many food industries such as ice cream, frozen food packs, gel stabilizers, emulsified products, and innumerable other usages, the subject was an informative one and highly interesting.

The Section held its Annual Spring Meeting on April 30th at Cornell University, Ithaca, N. Y. The Meeting took the form of an afternoon and evening program and the following papers were heard:

"New Knowledge of Nitrogen Compounds in Plants by the Use of Chromatography"—Dr. F. C. Steward, Professor of Plant Physiology and Botany, Cornell University.

(Continued on page 16)

Takes the WAVER OUT of spice flavor...



*Patented and Patents Pending

Laboratory Control Assures Predictable Flavor Quality in

SOLUBLIZED SEASONINGS

Now, you can improve the taste of your products with the smooth, mellow blend of **controlled** spice flavors in SOLUBLIZED SEASONINGS. Griffith chemists maintain a new high standard of potency, purity and uniformity in each extractive — by an exclusive extraction process* developed by Griffith research.

With each spice extractive always of uniform quality, blending is a laboratory science that assures flavor control for users of SOLUBLIZED SEASONINGS. That's a big sales advantage worth looking into—**today.**

The GRIFFITH LABORATORIES, Inc.

In Canada—The Griffith Laboratories, Ltd.

Another triumph of Griffith research—devoted solely to pioneering better food processing

CHICAGO 9, 1415 W. 37th St. • NEWARK 5, 37 Empire St. • LOS ANGELES 58, 4900 Gifford Ave. • TORONTO 2, 115 George St.

REGIONAL SECTION NEWS

(Continued from page 14)

"Better Breads and Cereals"—Dr. Estelle Hawley, Department of Pediatrics, School of Medicine and Dentistry, University of Rochester.

"Problems Encountered in Producing Ketchup as Compared with Other Products"—Mr. Lucien H. Cole, Chief Chemist, Quaker Maid Company, Inc., Brockport, New York.

"The Residues of Insecticides in Food Crops"—Dr. James E. Dewey, Associate Professor of Entomology, Cornell University.

"Quality Control Problems of Insecticide Residue from the Food Packers Standpoint"—Mr. W. F. Phillips, Head of Chemistry Section, Food Laboratory, Beechnut Packing Company, Canajoharie, New York.

"Chemical Additives in Processed Foods"—Dr. Willard B. Robinson, Technical Secretary, National Research Council, Food and Nutrition Board, Food Protection Committee.

A discussion and question period covering the three papers relative to chemical additives in foods.

Mr. Joseph R. Maxwell, President of the Vanilla Bean Association of American, Inc., was the after-dinner speaker and his subject: "Vanilla Beans on Parade."

PHILADELPHIA SECTION

The Philadelphia Section met March 2, 1954, at Drexel Institute. Mr. Pratt reported on his visit to the Southern California Section, and to the Carnation Milk Company plant and the Scripps Metabolic Institute.

A motion picture entitled "The Mark of C" was shown, which portrayed, in entertaining and dramatic fashion, the important part played by bread in the history of our nation from Colonial times down to the present.

Dr. Kohman introduced the speaker, Carlos A. Greenleaf, Assistant Director of the Washington Laboratories of the National Canners Association, who spoke on the subject, "Fluoridation of Water Supplies and What it Means to the Food Technologist." The history of events leading to the fluoridation of water supplies was discussed, including the experiments carried out by the U. S. Public Health Service at Newburgh and Kingston, New York, during the years 1945 to 1951. The statistical results of these experiments were shown in graphical form. The arguments against fluoridation were presented and evaluated.

The effects of using fluoridated water in food processing industries were discussed. Types of processed foods were divided into classes, to indicate which ones present a possible problem due to increases in concentration during processing. Examples were cited of measures taken to eliminate the danger of excessive concentration of fluoride in processed foods.

The Section met on April 20 at Drexel Institute. The following officers were elected for 1954-55:

Chairman: Carl D. Pratt
Vice-Chairman: L. W. Mahle
Secretary: E. C. Dryden
Treasurer: R. L. Mullan
Councillor: J. P. Crimmins
Executive Committee: Fred Jacobson, Albert Chaplin.

Colonel Lawrence, Business Manager of the Institute, was present and gave a short talk on the affairs of the national organization.

The chief speaker was Dr. Robert R. Williams, pioneer in vitamin research, whose investigations in the field date from the early years of the century, and who first synthesized thiamin in 1936. His talk on "The Enrichment of Foods" covered all phases of the subject, but was chiefly concerned with the enrichment of cereals, with which he has been most closely associated. Two films were shown—one on the enrichment of corn meal and grits in the southern United States, and one on the enrichment of rice in the Orient, including the recent dramatic experiment in Bataan, Philippine Islands, in which beri-beri was practically wiped out in the entire province.

PITTSBURGH SECTION

The Pittsburgh Section held its April Meeting on April 13th at the Royal York Dining Room. The meeting was known as "Ladies' Nite" and was very well attended by the members as well as wives and sweethearts. After a very pleasant and successful social hour and an excellent dinner the meeting was called to order by Chairman George Seagren.

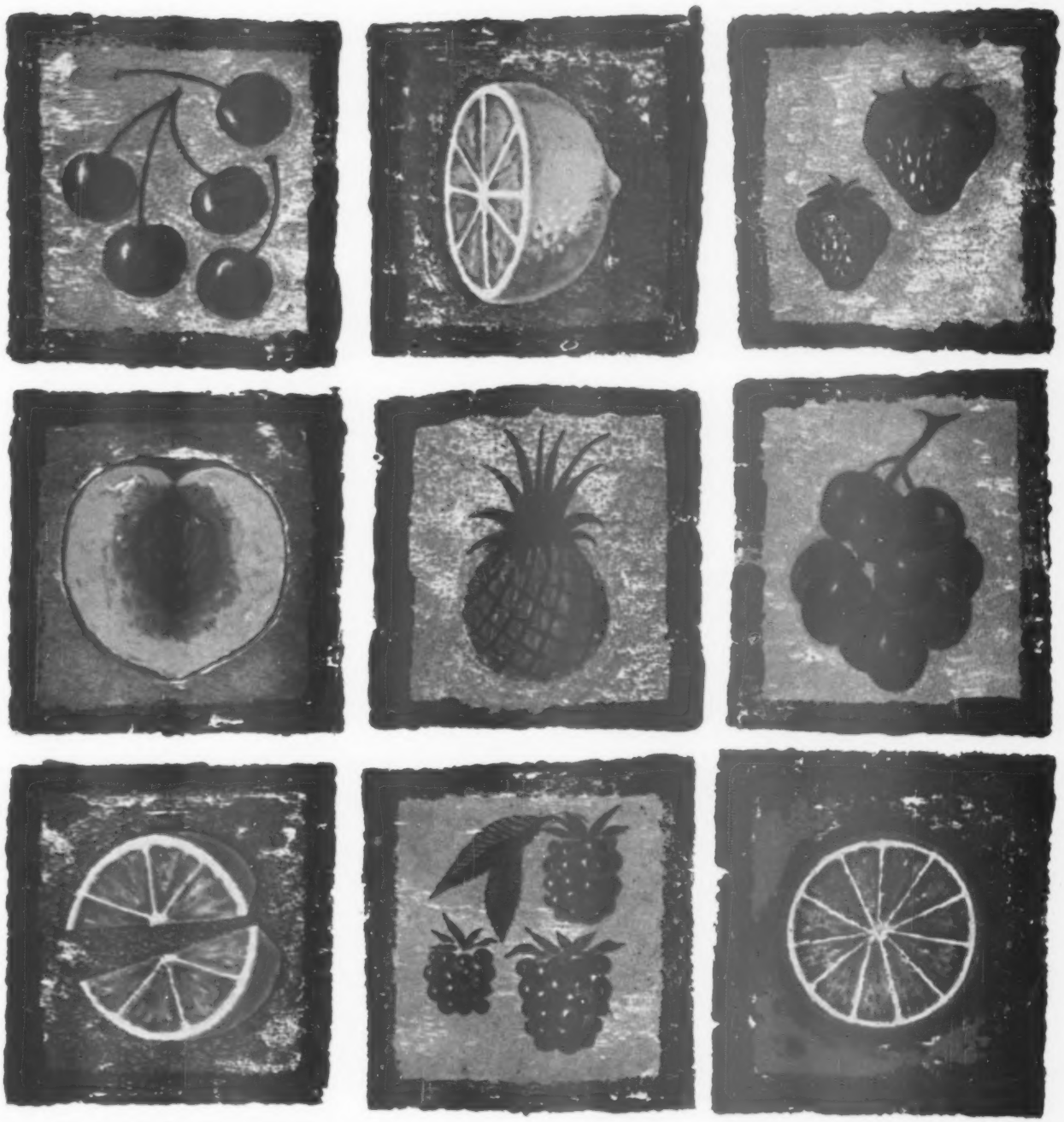
The nominating committee submitted its list of candidates for office for next year. An announcement of the next meeting was then made. It will be our annual meeting and will be held at the University Club on May 11th. Dr. H. Schreibner of the General Electric Corporation will discuss "The Use of High Energy Cathode Ray Sterilization in the Food Industry."

At the conclusion of the business meeting the speaker of the evening was introduced. Mr. Arthur Dimond, the Advertising Manager for the H. J. Heinz Co., gave an address "Fuel for Enthusiasm" which was profusely illustrated with slides and sound effects. He discussed the role of advertising as an essential part of a successful sales program. He brought out very clearly the need for enthusiasm as an essential ingredient for the successful salesman. His talk was most impressive and enjoyable and gave the audience a better understanding of advertising as a necessary stimulus to a sales campaign.

PUGET SOUND SECTION

The Puget Sound Section held its February meeting at the plant of the Fisher Flouring Mills Co. in Seattle, Washington, on the evening of February 24. Mr. William L. Haley, Director of Production and Controls, arranged for a complete mill and laboratory tour for the local Section of the Institute of Food Technologists. Fifty members and their guests had an opportunity to observe and study the complex operation at Fisher's which is one of the five largest millers of flour in the United States and, incidentally, is the largest flour mill west of the Mississippi River. Considerable interest was shown in the control and development laboratories. Following the tour the group assembled in the test kitchens to hear Mr. Haley give an account of the development of the company, its production, and the precise technical controls instituted to maintain uniformity of quality of

(Continued on page 18)



ATLAS TRUE FRUIT EXTRACTS

Atlas True Fruit Extracts assure highest quality and uniformity in your product. Available in many concentrations, including extra high concentrations for extract manufacturers.
Free laboratory consultation invited.

BLACK RASPBERRY • BLACK CHERRY • PEACH • STRAWBERRY • ORANGE • LEMON • LIME • PINEAPPLE • AND OTHER FLAVORS

FIRST PRODUCERS OF CERTIFIED COLORS

KOHNSTAMM & CO. Inc.

ESTABLISHED 1851

89 PARK PLACE, NEW YORK 7 • 11-13 E. ILLINOIS ST., CHICAGO 11 • 4735 DISTRICT BLVD., LOS ANGELES 11

BRANCHES IN OTHER PRINCIPAL CITIES OF THE U.S.A. AND THROUGHOUT THE WORLD

REGIONAL SECTION NEWS

(Continued from page 16)

their various products. After the talk Fisher's served each guest with an individual freshly-baked strawberry shortcake and coffee.

The Section held its March meeting at the U. S. Fish and Wildlife Service's laboratory in Seattle, Washington on March 18. The program consisted of a special showing of the laboratory's Open House exhibits which illustrated some of the work the Technological Section is doing in developing new fishery products and by-products and in developing new and improved methods of processing and preserving seafoods.

The meeting was held in conjunction with the Pacific Fisheries Technologists who were having their annual meetings March 18, 19, and 20 at the University of Washington School of Fisheries. A considerable number of IFT members are also members of the Pacific Fisheries Technologists.

Books

THE OLD COUNTRY STORE. By Gerald Carson; 330 pages, illustrated. Oxford University Press, published in New York, N. Y., $5.00.

The Old Country Store interprets for the food technologist, and of course for all who read it, an amazing variety of facts and "artifacts" that concern the manufacture, wholesaling, and distribution of foods during the many decades when the general store was a solid American institution. If one can use the simple formula that history records the course of ideas, channeled through institutions, and reflected in human behavior, then this book is a veritable mine of information for seeking out the vague origins of many of the merchandising ideas of today, for analyzing the growth of modern methods of distribution, and for tracing the development of behavior patterns that still characterize, in many ways, American men of industry and business—including the food business.

The idea of the country store grew out of two simple needs which accompanied the westward thrust of settlement—the need for the wherewithal for running a household and farm without going twenty-five or a hundred miles to get it and the need for a center of interest to tie a community of backwoods farms together. The country store rapidly became institutionalized by the demand, in an unspecialized economy, for services of other types—banking, tailoring, and even barbering—services not available except in the distant town or city. The behavior pattern of the country merchant was early established by the need to use, in lieu of hard cash which was often in a scarcity status, what he could get in kind—eggs, butter, firewood, oats, apples, etc., etc. Thus, he became—in spite of himself—a speculator. As such he had to be shrewd, learn to drive a good bargain, develop a one-man credit rating system based on horse sense, phrenology, and a little "inquiring around," maintain good discipline over his employees and, as the community grew, discharge his duties as the guardian of social, economic, and moral rectitude. In this latter role his contributions to the stability and discipline of American society were impressive.

Gerald Carson's competent account of the old country store is replete with anecdotes and descriptions that give a sudden and clear insight into an era of American life that is now only an afterglow. For example, there is the story of the stoveside patron who inquired of the storekeeper as to the whereabouts of his man-of-all-work:

"Where's Eddie—is he sick?"

"No. He's through."

A pause . . . and then:

"Got anybody in to fill the vacancy?"

The storekeeper thoughtfully went on with his dusting, and then said briefly:

"Nope. Eddie didn't leave no vacancy."

But the storekeeper was by no means a harsh and unrelenting character. Carson gives many instances of the fact that a certain constant behavior was expected of him. He had no choice. Unless he was pleasant, accommodating, patient, well spoken, had abiding faith and steady nerves, he would lose his business to the first competitor who opened a rival store in the neighborhood. But the American tradesman never had to be servile to his customers nor apologize for his stalwart conservatism. The community around him was keenly aware of the realities. The storekeeper—at least the good storekeeper—represented the whole complex pattern of buying and selling. Without his knowledge and acumen it would have been difficult indeed for a community to rise above the level of bare subsistence. With his knowledge and acumen there came prosperity—and a better life for all.

Carson provides an immense number of sidelights on topics of background interest to the food technologist—sanitation (not too good); packaging (incredibly clumsy at times); attitudes toward new forms of food (usually suspicious, at least at first); the invention of new foods or packaging (sometimes thought up by the "drummers" or travelling salesmen) and modes of keeping perishables (rudimentary).

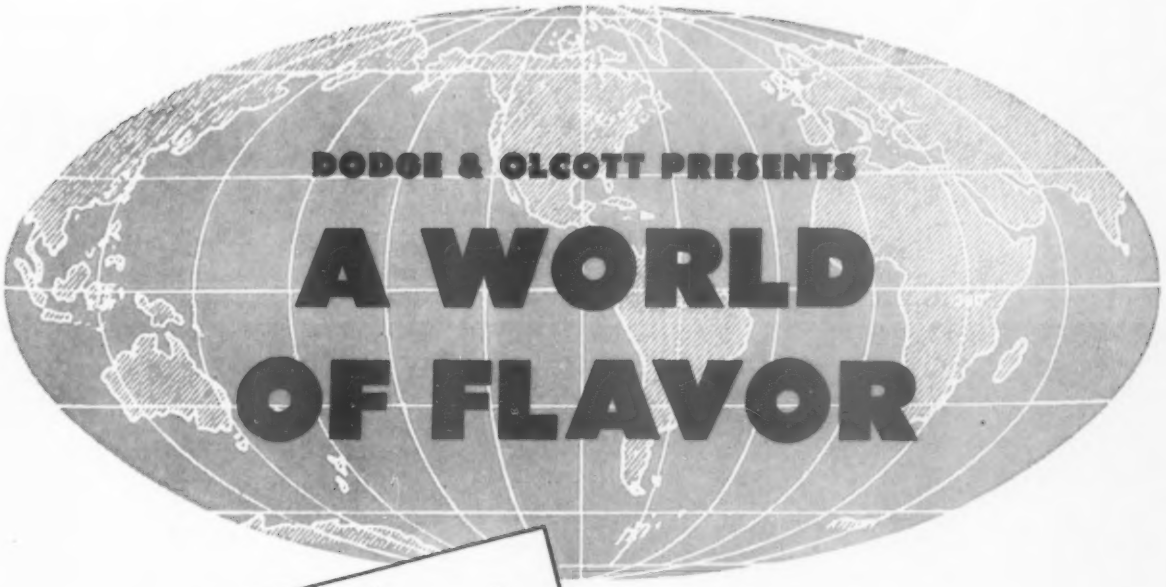
The Old Country Store is good collateral reading for all food technologists, required reading for those concerned with its distribution. There are sermons in stones—and also in the old cracker barrel, so admirably pictured in color in the frontispiece to *The Old Country Store.*

MARTIN S. PETERSON
Chicago, Illinois

SWEET CORN. W. A. Huelsen, University of Illinois. Published by Interscience Publishers, Inc., New York, N. Y., as Volume IV, *Economic Crops,* 409 pages, 1954.

This text, written by one eminently qualified to review and discuss all aspects of the subject, includes fundamental and applied aspects of sweet corn from botanical and horticultural to farm and plant management considerations. The author has had an unusually unique opportunity throughout a long period of years to study and contribute to basic concepts through experiment station projects, while at the same time he has maintained close contact with seedsmen and canners in order to understand and pursue their problems.

(Continued on page 22)



DODGE & OLCOTT PRESENTS

A WORLD OF FLAVOR

Brought from the far corners of the earth...processed into specific forms required by all the varied segments of the food industry...

The D&O World of Flavor comes to you through the courtesy of international markets, the D&O Flavor and Product Development Laboratories and the Annual Meeting of the Institute of Food Technologists in Los Angeles, June 27-30. See how a single spice or herb can be prepared in seven different forms for specific flavoring application. See and test the differences between the Essential Oil, Oleoresin, Spiceolate, Spisoresin, Dry Soluble Seasoning, Concentrate and Synthetic Compound of a specific natural product. Visit the D&O Booth, #7 and #8, for your tour of, "A World of Flavor".

Our 155th Year of Service

D&O
ESTABLISHED 1798

DODGE & OLCOTT, INC.

180 Varick Street • New York 14, N. Y.

Sales offices in principal cities

ESSENTIAL OILS • AROMATIC CHEMICALS • PERFUME BASES • FLAVOR BASES • DRY SOLUBLE SEASONINGS

words that speak of action!

Here are examples of the way Pfizer products are now being used to cut processing

Packers can cut smokehouse time of cooked, cured, comminuted meats by ⅓ or more with Pfizer Ascorbic Acid or Sodium Ascorbate. In many instances these products give better color retention. They are easy to use . . . simply dissolved in water and added near the end of the chop. Inexpensive, too . . . averaging approximately a quarter-cent for each pound of finished product.

A smoother, creamier tasting product is the result of emulsifying process cheeses with Pfizer Sodium Citrate. This pleasant-tasting salt of citric acid improves the slicing characteristics . . . makes process cheeses non-crumbling and uniform. It serves ideally, too, for cheeses that are to be remelted in cooking, making possible the smooth, even quality all cooks desire.

It takes only a few words to get action

when you're dealing with your Pfizer sales representative

Suppose, for instance, you are seeking advice on giving one of your present food products more sales appeal. Or, you may be considering the production of a new or improved product. On the other hand, you may be finding that excessive processing costs are threatening to price your line out of the market. Whatever your problem, discuss it with your Pfizer sales representative. He may find the answer in the vast experience Pfizer has gained in working with the food processing industry for nearly a century.

costs or to add sales appeal to foods and beverages.

Carbonated beverages enriched with Vitamin B_1 and Vitamin C have already proved to be big sales getters. Additional experimental work . . . fortifying beverages with Vitamin B_{12} is now being carried on. Vitamin-fortified carbonated beverages may be *your* next sales success. Contact Pfizer for information accumulated in more than 17 years as a leading vitamin manufacturer.

CHAS. PFIZER & CO., INC.

630 Flushing Ave., Brooklyn 6, N. Y.

Branch Offices: Chicago, Ill.; San Francisco, Calif.; Vernon, Calif.; Atlanta, Ga.

Manufacturing Chemists for Over 100 Years Pfizer

Whenever you have a food processing problem, talk it over with your Pfizer sales representative. He'll be glad to assist you.

BOOKS

(Continued from page 18)

This is a literature review noteworthy for its current and extensive coverage. Mention is made of such recent topics as the use of radioactive isotypes, soil conditioners, cytoplasmic male sterility, high-short process, and even the price-support problem. Evaluation and summarization of subject matter is not emphasized. An excellent feature is an extensive bibliography for each item in the table of contents. Subject and author indices are adequate. Inadequate detailed coverage of a few subjects related to processing is due not to lack of initiative by the author but to trade "secrets."

This significant milestone in writing is a much-needed text in the reference library of every corn breeder, seedsman, and canner. It is written in a readily understandable manner scientifically accurate yet spiced with the jargon of the sweet corn industry.

The breadth and depth of the volume is indicated by the chapter headings: history of sweet corn; taxonomy and morphology; open pollinated varieties and their use; breeding sweet corn hybrids; germination and growth of the seed; physiological aspects of germination, growth, and maturity; mineral nutrition of the plant; the plant in relation to its environment; history of the corn canning industry; contracting and handling the raw product; factors affecting canning operations; freezing, salting, and dehydrating; nutritional value of sweet corn; and a statistical summary.

Wm. R. Kehr
U.S.D.A., Univ. of Nebraska,
Lincoln, Nebr.

Selected Abstracts*

ANALYTICAL CHEMISTRY

The mechanism of the interaction of sulfur dioxide with certain sugars.

Braverman, J. B. S. *J. Sci. Food Agr., 4,* 540-7 (1953).

In the course of certain studies on the behavior of SO_2 in concd. citrus juices and other sulfited food products it was suggested that SO_2 may yield an addn. product only with the aldehydic open-chain form of certain sugars. Exptl. results are presented here to show that the sulfonate is an open-chain compd., namely elementary analyses coupled with the state of hydration of the product, the measurement of its i. r. absorption spectrum which indicates the absence of a C-O-C bond, and the detn. of its optical rotation.

New technics for adding organic acids to silicic acid columns.

Zbinovsky, V., and Burris, R. H. *Anal. Chem., 26,* 208-10 (1954).

A method is described for adding the org. acids or their Na salts in the aq. phase, which facilitates the quant. introduction of the acids into the column and eliminates any difficulties from dehydration of the silicic acid. They may also be introduced as a uniform, narrow band by adding them in blotter disks.

Separation and identification of coumarin and four other vanilla-like flavoring substances by paper chromatography.

Mitchell, L. C. *J. Assoc. Offic. Agr. Chemists, 36,* 1123-7 (1953).

Mixts. of coumarin and 4 other vanilla-like substances (piperonal, vanillin, ethyl vanillin, and Vanitrope) can be sepd. by paper chromatography. The sheets are impregnated with a soln. of formamide in EtOH and Et ether, and are developed with mixed octanes. The components are detected on the paper by spraying on duplicate with KOH (not applicable for piperonal) and the other with hydrazine sulfate (not applicable for coumarin and Vanitrope).

BIOLOGICAL SCIENCES

BIOCHEMISTRY

Action of rennet. I.

Tewes, G. *Biochem. Z., 323,* 119-32 (1952); *Brit. Abstr., AIII,* 687 (1953).

Milk was obtained under aseptic conditions and the course of its coagulation by rennet studied. In the case of whole milk this coagulation followed a time course which varied with the age of the milk sample. Milk denatured by heat or treated with neutral salts or penicillin G no longer showed conglomeration of protein complexes. There appears to be a relation between the lack of coagulation and the change in the dissociable Ca complex. The phosphoproteins obtained from milk are found to ppt. in the cold without change in pH when the concn. of added $CaCl_2$ is raised to 0.7%.

The mode of action of the Q-enzyme of *Polytomella coeca.*

Barker, S. A., Bebbington, A., and Bourne, E. J. *J. Chem. Soc.,* 4051-7 (1953).

The rate of conversion of potato amylose into amylopectin by the Q-enzyme of *Polytomella coeca* is increased markedly when maltosaccharides of short av. chain-length are introduced. Other saccharides, devoid of α-1:4-glucosidic linkages, do not have this effect. The maltosaccharides probably serve as receptors of dextrin chains transferred by the enzyme, a view which derives support from the fact that, in the presence of C^{14}-maltose, the enzyme converts amylose into a polysaccharide which displays C^{14}-activity.

A comparison of the action of several alpha amylases upon a linear fraction from corn starch.

Kung, J. T., Hanrahan, V. M., and Caldwell, M. L. *J. Am. Chem. Soc., 75,* 5548-54 (1953).

Evidence is presented that α-amylases from different sources differ markedly in their action on the same linear substrate. These differences are discussed.

MICROBIOLOGY

Coliform detection in water by a single-step technic using the membrane filter.

Hajna, A. A., and Damon, S. R. *Public Health Reports, 69,* 58-60 (1954).

The millipore filter is used. The formula for a desoxycholate lactose broth to be used in the MF technic is given. An advantage of the desoxycholate lactose broth medium in the MF procedure for H_2O analysis lies in the fact that enrichment of the filter is eliminated. With this technic results are obtained earlier than by standard methods of H_2O analysis. Many of the false pos. lactose broth tests encountered in standard method of H_2O analysis are eliminated.

Enhancement of antibiotic production by the use of sea water media.

Jann, G. J., Walch, H. A., and Salle, A. J. *Appl. Microbiology, 1,* 224-7 (1953).

It was shown that sea water is superior to NaCl, tap water, or distd. water for antibiotic production by a group of streptomycetes. This would indicate that certain trace elements present in sea water play an important role in the metabolism of the organisms.

Quantitative adsorption of crystal violet.

Kennedy, E. R., and Barbaro, J. F. *J. Bacteriol., 65,* 678-80 (1953).

The uptake of crystal violet by bacterial cells can be measured quantitatively by micro-Kjeldahl analyses. Heat-killed staphy-

(Continued on page 26)

* These Selected Abstracts are made available to Food Technology through the cooperation of Associate Editor H. A. Campbell and the General Foods Corporation of New York, N. Y. The abbreviations found in these abstracts are similar to those used by Chemical Abstracts.

KEY BRAND®
Essential Oils
There are no finer!
• OIL OF ORANGE cold pressed U. S. P.
• OIL OF LEMON CALIF. cold pressed U. S. P.
• OIL OF GRAPEFRUIT cold pressed
• OIL OF MANDARIN (tangerine) cold pressed
• OIL OF LIME, distilled and expressed
• TERPENELESS & CONCENTRATED CITRUS OILS
Achieve new, original taste effect by blending Key Brand Essential Oils, Key Brand Terpeneless Oils and Concentrated Oils for greater strength and improved solubility.
Write for Samples and Quotations
FLAVORS • ESSENTIAL OILS • AROMATICS
FELTON CHEMICAL COMPANY, INC.
599 Johnson Avenue, Brooklyn 37, N. Y.
PLANTS BROOKLYN, N. Y. LOS ANGELES CAL. MONTREAL QUE. VERSAILLES (S&O) FRANCE
SALES OFFICES ATLANTA • BOSTON • CHICAGO • CLEVELAND • PHILADELPHIA • ST. LOUIS • TORONTO

pH in food processing

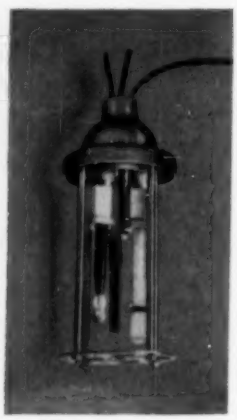
Making better food products at lower cost . . .

ACIDITY and alkalinity are more than a matter of taste in food products. They are chemical characteristics that influence many food qualities and processing operations. Through the application of modern instrumentation, these characteristics can be readily measured and often controlled automatically.

What is pH?

Chemists have devised the pH scale as a means of expressing the acidity or alkalinity of a solution. The scale extends, for all practical purposes, from 0 to 14. The numbers are a way to measure the concentration of hydrogen ions in a solution. Pure water has a pH of 7. Below 7, solutions are acid; the more acid, the lower the pH number. Conversely, alkaline solutions have a pH value above 7, and keep getting higher as they become more strongly alkaline. The scale is logarithmic; a change of 1 pH means a ten-fold change in the hydrogen ion concentration.

Flow type electrode assembly.



Immersion type electrode assembly.

How is it measured?

Formerly requiring elaborate laboratory equipment, pH measurements are made today in many industries by means of the glass electrode system. This consists of a pair of elements, one of which has a special glass bulb at its tip, continuously immersed in the solution to be tested. The electrical millivoltage which this system develops is measured by an electrometer and is recorded directly in pH units by an *ElectroniK* potentiometer.

How about control?

The *ElectroniK* pH instrument can often regulate the flow of a corrective reagent to hold pH at a set value . . . thus eliminating the uncertainties of manual operation. For instance, if a product is slightly acid and it is desirable to make it neutral, the instrument actuates a valve to adjust the addition of an alkaline solution. pH control requires engineering by a Honeywell specialist, who takes into consideration such factors as reaction time, buffering action and process lags. When properly designed, pH control can make valuable contributions to product quality, uniformity and economy in many food processes.

Instrumentation for continuous cream neutralization at Level Valley Dairy. Developed by Roy Robichaux of the pH Robotrol Co., this process is controlled by an ElectroniK pH instrument.

. . . through automatic pH control

THE WAY that modern instrumentation can help convert a hit-or-miss batch process into a closely regulated, continuous operation is well exemplified by the continuous cream neutralization system at the Level Valley Dairy, West Bend, Wis. Under the control of an *ElectroniK* pH instrument, this process automatically adjusts the acidity of cream going through a continuous pasteurizer. Here, as in other dairies where the *pH Robotrol* process is operating, several outstanding benefits are being realized.

Improved flavor—no oxidized taste, no "tallowiness" from overneutralization.

Longer storage life—butter stays fresh longer; doesn't get "fishy" due to over-acidity.

Faster production—continuous, fully automatic process eliminates delays of batch operation; ends need for accumulating cream receipts before processing. Many plants can double daily production!

Honeywell instrumentation offers food processors unlimited opportunity to improve efficiency and product quality. At your service is a thorough line of measuring and controlling instruments encompassing practically every food process—plus an extensive background of engineering experience in the control problems of the industry. Your nearby Honeywell sales engineer will be glad to discuss your own plant's applications . . . and he's as near as your phone.

MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, Wayne and Windrim Aves., Philadelphia 44, Pa.

● **REFERENCE DATA:** Write for Catalog No. 1550 and Instrumentation Data Sheet No. 3.4-9.

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

SELECTED ABSTRACTS

(Continued from page 22)

lococci adsorbed more crystal violet than formalin-killed cells. Heat and formalin-killed *Salmonella typhosa* cells adsorbed the same quantity of crystal violet.

Symposium on lactic acid bacteria.

TITTSLER, R. P., PEDERSON, C. S., SNELL, E. S., HENDLIN, D., AND NIVEN, C. F. *Bacteriol. Revs., 16,* 227-54 (1952).

Systematic relationships, nutrition, industrial significance and use of the lactic acid bacteria in microbiol. assays are discussed.

NUTRITION

A microbiological approach to nutritional evaluation of proteins.

HALVEY, S., AND GROSZOWICZ, N. *Proc. Soc. Exptl. Biol. Med., 82,* 567-71 (1953).

Proteins are digested with proteolytic enzymes and the digests assayed for released amino acids microbiologically. A single assay yields a result comparable to ordinary protein quality consts. These fall when protein is heated with carbohydrate. Gelatin is found to be low in 5 amino acids. This procedure should prove to be valuable, rapid and inexpensive.

Correlation between the biological value of protein and the percentage of creatinine N in the urine.

MURLIN, J., HAYES, A. D., AND JOHNSON, K. *J. Nutrition, 51,* 149-61 (1953).

The high degree of correlation between biol. values and creatinine N percentages in the urines of the last days of any given period of protein ingestion entitles this constituent of urinary N to consideration as a baseline of reference for the evaluation of proteins. With a very poor protein the amt. of N appearing in the urine is large; the creatinine portion of the total N therefore is a small percentage; and vice versa for a good protein. The correlations arrived at in these expts. lend themselves to prediction of biol. values from creatinine N percentages.

Nitrogen balance and growth of the rat as affected by certain fruits in the diet.

SILICIANO, A. M., AND NASSET, E. S. *J. Nutrition, 51,* 403-11 (1953).

N balance observations were made on adult rats which were pair-fed diets low in protein (2.5% and 5.0%). Casein was compared with an isonitrogenous mixt. casein (50%) and banana protein (50%). The N balance was unaffected by adding the fruit protein. The fecal N, however, was greatly increased and the urinary N correspondingly decreased when casein and banana protein were fed together. The N balance index of absorbed N was, therefore, increased as the result of supplementing casein with banana protein. The addn. of 9% fresh fruit pulp solids from banana, pineapple and apple failed to affect significantly the growth of weanling rats fed *ad libitum.*

The effect of mucin on the growth of rats fed simulated human milk.

TOMARELLI, R. M., LINDEN, E., DURBIN, G. T., AND BERNHART, F. W. *J. Nutrition, 51,* 251-9 (1953).

Hog gastric mucin, a potent source of a microbiol. growth factor also present in human milk, when fed with a basal diet of a compn. approximating that of human milk resulted in increased growth and, in some cases, increased survival time of weanling rats. The biol. effect of mucin was demonstable with a modified skim cow's milk ration, with a semi-synthetic diet composed of casein, lactose, hydrogenated cottonseed oil and salts, and with milk rations contg. iodinated casein. The destruction of the microbiol. growth activity of mucin by prolonged acid hydrolysis also resulted in a loss of the rat growth activity.

The influence of dietary fat and carbohydrate on growth and longevity in rats.

FRENCH, C. E., INGRAM, R. H., URAM, J. A., BARRON, G. P., AND SWIFT, R. W. *J. Nutrition, 51,* 329-30 (1953).

Male and female rats receiving a high fat diet (22.7% fat) grew fully as rapidly as those on a carbohydrate diet (3.4% fat), although they consumed 4.8 and 5.7% less total cals., resp. The life span of male rats ingesting the high fat diet decreased markedly and there was also a less pronounced but significant decrease in the longevity of the females. Increased efficiency of utilization of the diet was correlated with decrease in life span, but increased cal. intake *per se* was not so assocd. The livers of males on the high fat diet contained significantly more fat than those of males fed the carbohydrate diet. The histopathological data and the frequency of diseases and abnormalities, however, revealed nothing that could be interpreted as a fat-induced cause of premature death.

Experiments on the food preferences of wild rats.

BARNETT, S. A., AND SPENCER, M. M. *J. Hyg., 51,* 16-34 (1953); *Nutrition Abstr. & Revs., 23,* 882, No. 4865 (1953).

Seven colonies, each consisting originally of 10-18 adult wild rats of both sexes, were used. During all expts. the rats had a surplus of cereal food and received also cabbage once a week and horse liver once a fortnight. In all, 76 expts. were made, each lasting for from 6-35 days. In 2 tests a choice of 3 foods was provided and in all the rest 2 foods. The results are presented in detail. Wholemeal was preferred to wheat grains and the latter to white flour. Little or no white flour was eaten if wholemeal was the alternative. Wheat germ was eaten only in small amts. if an alternative cereal was available, but more was taken if the alternative was sugar or a sugar-cereal mixt. The addn. of sugar or saccharin to cereals increased acceptability; the former was preferred. Arachis oil added to wholemeal or wheat increased and 2.4% cod liver oil decreased acceptability. Wet foods were eaten in larger amts. than dry foods.

Influence of dietary aureomycin and carbohydrate on growth, intestinal microflora and vitamin B_{12} synthesis of the rat.

PETERSON, G. E., DICK, E. C., AND JOHANSSON, K. R. *J. Nutrition, 51,* 171-89 (1953).

Weanling rats fed a purified diet deficient in vitamin B_{12} grew faster with dextrin as the sole dietary corbohydrate than with sucrose. The incorporation of aureomycin (100 p.p.m.) in these rations stimulated growth, even when the rations were fortified with vitamin B_{12} (25 μg./kg.). The feeding of aureomycin rapidly induced changes in the intestinal microflora which were influenced to a marked degree by the type of dietary carbohydrate (sucrose or dextrin).

Lack of methionine causes hardening of arteries.

U. S. I. Chem. News, January, 1954.

In work recently completed at a leading medical school atherosclerosis was produced in *Cebus* monkeys weighing between 1-2 kg. by feeding diets high in cholesterol and low in methionine over periods of 18-30 wks. Within 2-8 wks. this diet caused hypercholesterolemia with consequent atherosclerosis and lesions in the ascending aorta and other heart arteries. This condition was also dependent on adequate choline being furnished by the diet. It was found that the hypercholesterolemia could be largely prevented by feeding 1 g./day of DL-methionine as a supplement to the diet. According to the report, once the hypercholesterolemia had been created by the diet, blood cholesterol level could be restored to normal by feeding 1 g. of methionine daily.

Effects of niacin and niacinamide on blood sugar.

BERA, G. N. *Am. J. Physiol., 175,* 296-8 (1953).

Niacin and niacinamide, injected intramuscularly into fasted rabbits with or without glucose, caused a distinct rise in blood sugar in each case reaching a max. about 1 hr. after injection. At this time the av. niacin content of the blood was also found to be maximal. It is concluded that niacin or its amide on intramuscular injection provokes the secretion of adrenaline which is very high when the niacin content of the blood is also very high.

On what substances does the effect of oat days in diabetes depend?

HEUPKE, W., AND KOLB, A. *Deut. Z. Verdauungs- u. Stoffwechselkrankh., 13,* 111-15 (1953); *Nutrition Abstr. & Revs., 23,* 918, No. 5083 (1953).

To investigate the reason for oat soups being so well tolerated by many diabetic persons, 100 expts. were made on 20 patients with different fractions prepd. from oats. A prepn. which had been enriched with oat protein had a more unfavor-

(Continued on page 28)

Total filling time: 7 seconds!

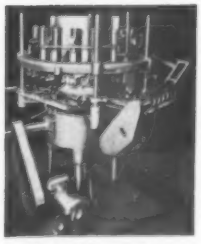
Shown in this picture are just a few of the many leading brands handled on Pfaudler high-speed fillers. At speeds ranging from 200 to 600 cans per minute, not one of these containers required over 2/5 of a second filling time.

How you can profit from Pfaudler high-speed filling ... as these leaders do!

Your containers don't linger on a Pfaudler filler. In just 1/5 of a second—faster in many cases—anything from thick soups, sticky syrups or semifrozen juices can be accurately filled and hustled off to the closing machine!

You save time, increase your production and eliminate spillage! This is why leaders in the food industry use Pfaudler fillers to pack the products shown above (and many more!).

Fill 350-400 cans a minute



RP-14 Piston Filler

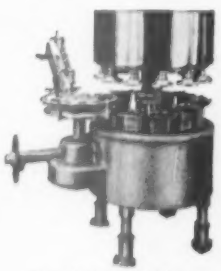
You can fill any container from 3 to 32 ounces, with semi-liquid products, when you use this Pfaudler RP-14 piston filler. It has the Pfaudler "no-can-no-fill" feature that prevents spilling your product when there is no container under valve. Filler heads are easy to dismantle for cleaning. This can be done quickly, without requiring any special tools. And you can easily regulate the fill of its 14 pistons by turning a single quick-adjusting screw, even while machine is in operation.

Up to 600 containers a minute

You enjoy all the advantages of the RP-14, plus extra speed, with this RP-21 piston filler. As on other Pfaudler fillers, all contacting parts are stainless steel and copper-free nickel alloy. RP-21 fills containers of 3 to 16 fl. oz.

Fast filling of liquids

You fill up to 400 containers a minute with this Pfaudler gravity flow filler. Changes over easily from one size container to another. Fills cans from 8 oz. to No. 10 size. Stainless steel open-air tube valves, stainless steel reservoir, and fully enclosed turret and base assembly for maximum sanitation.



Gravity Flow Filler

For further information of the efficiency of high-speed filling, mail the coupon today!

Pfaudler

THE PFAUDLER CO., ROCHESTER 3, NEW YORK
Engineers and Fabricators of Food Processing Equipment

Gravity Fillers · Piston Fillers · Steam Peelers · Deaerators · Vacuum Pans · Evaporators

THE PFAUDLER CO., Dept. FT-6, Rochester 3, N. Y.

Please send me information on:
- ☐ Pfaudler Rotary Piston Fillers
- ☐ Pfaudler Gravity Flow Fillers

Name .....

Title .....

Company .....

Address .....

City ..... Zone ..... State .....

MAGNA spice concentrols —scientific formulations of spice essential oils and oleoresins . . . the most concentrated flavoring materials available.

advantages:

- 100% pure, natural products obtained by distillation or extraction from *actual* leaves, herbs, roots, buds or berries.
- Contain no diluents or inert materials of any kind.
- More economical because they are more concentrated, yet readily diluted in your own plant.

Write for your copy of "Questions and Answers" for the food processor. Learn how the development of Magna Spice Concentrols has modernized the seasoning of food products . . . and cut seasoning costs.

MAGNUS, MABEE & REYNARD, INC.

Since 1895 • One of the world's greatest suppliers of essential oils

16 Desbrosses Street, New York 13, N. Y. • 251 North La Salle Street, Chicago 1, Ill.

SELECTED ABSTRACTS

(Continued from page 26)

able affect on sugar excretion than had oat flakes, so that oat protein cannot be the constituent concerned. An aq. ext. of oats given for 7 days caused no improvement in sugar tolerance. Pure oat starch was tolerated in greater amts. than was rice or wheat starch, possibly because of some difference in the compn. of the oat-starch mol. The addn. of 30 g. oat mucilage to 150 or 170 g. oat flakes caused little or no increase of glycosuria, and this mucilage may be concerned in the favorable effect of oats on diabetic subjects. The fraction consists mainly of pentosans, is not broken down by diastase and, gives the chyme in the small intestine a colloidal character which delays the diffusion of the sugar mol. There the sugar formed from the oat starch is absorbed by the intestinal wall more slowly than is the sugar from potato, wheat, or rice flours, which contain mucilaginous substances in much smaller amts.

Nature of "vitamin A-like factor" in lard.

HEBB, S. F., RIEMENSCHNEIDER, R. W., KAUNITZ, H., AND SLANETZ, C. A. *J. Nutrition, 51,* 393-402 (1953).

Biol. assays on mol. distillates from lard showed that lard contains vitamin A activity equiv. to about 0.4-2 units per g. Chromatographic fractionation of unsaponifiables from lard and mol. distillates from lard yielded eluates which gave positive Carr-Price tests and typical vitamin A spectral curves, except in fractions having an extremely high ratio of unsaponifiables to units of vitamin A. It is concluded that the biol. vitamin A activity of lard is largely attributable to the presence of typical vitamin A. The so-called "sparing" action of lard on utilization of added vitamin A in diets is in all probability due to the presence in lard of hitherto unrecognized typical vitamin A.

Why solid foods for newborn?

DOUGLASS, F. H. *Northwest. Med., 52,* 832 (1953); *J. Am. Med. Assoc., 154,* 275 (1954).

Enzymes for all simple foods, except starches, apparently are available, even before birth, but pancreatic amylase remains relatively deficient for some months of early infancy. In the stomach, both free and total acids are high for the first 2 days and then rapidly fall off. They do not recover until after 1 month. Although infants may tolerate many formula modifications, none has ever surpassed nature's product, breast milk. Many believe that early feeding of complex foods is responsible for many of the allergies of today.

PHYSIOLOGY AND MEDICINE

Oatmeal medicine.

Today's Health, 32, 16, January, 1954.

The drugs made from furfural, a by-product of oatmeal, show anti-spasmodic or calming effects on the stomach and are useful in treating stomach ulcers.

Physiological damage under emotional stress as a function of early experience.

WEININGER, O. *Science, 119,* 285-6 (1954).

One group of male albino rats were gentled for 21 days, while a similar group was not handled at all. At 79 days of age the gentled group had a mean wt. of 319.00 g. as compared to 264.75 g. for the ungentled group. The gentled group also had relative immunity to stress damage. This was probably due to a decreased output of ACTH from the pituitary in response to an alarming situation which was also faced by the nongentled animals.

TOXICOLOGY

Short-term feeding studies in infants and children with certain surface-active agents used in food technology; absence of evidence of toxic effects.

PRESON, E., HUNT, A. D., SCOTT, T. F. MCN., AND SPUR, B. *J. Clin. Nutrition, 1,* 539-50 (1953).

The substances chosen were Span 60, Tween 60 and Myrj 45. The plan was to feed these substances to "normal" children, the amt. fed being markedly greater than that which would normally be encountered either in foods or in therapeutic dosage, although not in the amts. deleterious in animals. No harmful effects, as reflected in behavior, general health, appetite, frequency or consistency of stools, or wt. gain were noted in the normal children. No gross laboratory evidence of toxicity, as reflected in blood

(Continued on page 34 following technical papers)

Guiding Principles for the Solution of Dietary Problems of an Aging Population[a, b]

CHARLES S. DAVIDSON, M.D.[c]
Harvard Medical School, Boston, Massachusetts

(Manuscript received January 23, 1954)

In my estimation, nutrition has a profound influence on the health and happiness of our aging population. Today, as we all know, our chronic disease and mental hospitals are filled to overflowing. Looking at nutrition and aging as a physician, one sees a great many old people in his daily ward rounds in a hospital. Many of these hospitalized people are just old—no longer able to care for themselves, and no one at home to care for them. Many more are not hospitalized but are in their families' homes and nursing homes where they may be problems to their families or to others.

What can be done to help these old people and to lighten the problem for their families and for society? As Dr. Sebrell[d] emphasized, the number of aged persons is rapidly increasing. In 1950 over 11% of our population, that is about 18,000,000 people, were over 60. Or, to put it another way, for each 100 persons of what may be called productive age, between 20 and 59 years, there are some 22 in the dependent age group, that is, over 60. The cost in economic terms for the care of unproductive people is immense. The cost in terms of hardship to families and unhappiness and loneliness to these old folks themselves is incalculable. We must try to make these old people productive, so that they can support themselves at least in part, so that they can be happier, more secure, and less lonely; in other words, a part of society, not cast-offs. Can this be done? Can we in fact delay senescence? Aren't the cards already stacked? Will not aging of the individual progress irrespective of our efforts? No one can truthfully answer these questions at present, and insufficient effort has been made to find out. Competent investigation must be made on a far wider scale to determine to what degree we can delay or alter the consequences of aging. The problem is really not just one of rehabilitation, but equally or more importantly, one of prevention. We don't know what we can accomplish until we make the effort. Many organizations, especially as Dr. Sebrell mentioned, the U. S. Public Health Service, are interested in working on this problem, and there are a number of excellent reference works and journals devoted to the study of aged individuals.

The attack on aging must be multifaceted. Many disciplines of knowledge will be required. Physicians, social scientists, psychiatrists, nutrition experts and social workers and others must work together to plan. Those interested in food and nutrition, such as we are here today, must play an important part in this work.

What do we know about food for the aged? Here again the facts are few, and extensive research is necessary. The problem may be discussed from two main points of view. First, what is the effect of aging on nutrition? The process of senescence—what is its effect on the individual as he grows older, in other words. Secondly, what is the effect of nutrition, good and bad, upon the aged, particularly before senescence begins? The answers to both these questions are little known.

AGING AND NUTRITION

Let us consider first the effect of aging upon an individual's nutrition. As we look at old people around us, many are thin and scrawny. If obese, their lean body mass, that is, what is left if the fat were removed, is frequently reduced far below normal amount. That is, under-nutrition is the rule for elderly people. I think this is shown from some work of Dr. Robert Monroe, of the Peter Bent Brigham Hospital, in which a group of old people were studied (Table 1). In the first column, the percentage of individuals underweight, the second column, those with normal weight and then three columns for obesity, moderate, considerably overweight, and extremely overweight, and in the far right, the obese individuals disappear in the older age groups, virtually, and by the age of 80 and over, almost half of the population is underweight and most of the rest are either normal or constantly normal weight. This gives

[a] From the Thorndike Memorial Laboratory, Second and Fourth Medical Services (Harvard), Boston City Hospital, and the Department of Medicine, Harvard Medical School, Boston, Massachusetts.

[b] Presented at the Thirteenth Annual Meeting, Boston, Massachusetts, June 22, 1953.

[c] Associate Professor of Medicine, Harvard Medical School.

[d] W. H. Sebrell, Jr. Aging, nutrition, and public health. FOOD TECHNOLOGY, 7, 346 (1953).

TABLE 1

Years	Underweight		Normal weight		Moderately overweight		Considerably overweight		Extremely overweight		Total	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
61-65	28.6	17.6	39.8	47.7	21.1	22.3	8.5	9.3	1.9	2.9	1783	1754
66-70	30.5	16.5	45.2	46.8	16.3	22.7	6.1	9.5	1.8	4.2	1176	1080
71-75	29.8	23.6	49.7	48.8	13.9	17.6	5.0	5.9	1.3	4.1	651	623
76-80	39.1	30.5	47.9	41.1	8.1	18.5	4.2	8.7	0.7	1.1	281	265
81-85	45.8	38.3	42.7	31.4	11.4	15.1	—	10.4	—	4.8	96	86
85	44.0	42.8	48.0	35.7	8.0	14.3	—	3.5	—	3.5	25	28
Total	30.8	19.8	43.6	46.7	17.0	21.2	6.7	8.7	1.6	3.4	4012	3836

some idea of the incidence of under-nutrition in old age. It is not safe to conclude, however, that moderate under-nutrition is dangerous, but when it is carried to extreme it surely is not a healthy situation. Instances of specific nutritional deficiencies are more common in old individuals than they are in the young, as well. Now, why is it that senescence is often accompanied by failing nutrition? What are the factors?

The requirements for individual nutrients in the aged are little known, as Dr. Sebrell noted. It is usually assumed that they differ little from those of younger adults. This may not be quite true. There is evidence that old folks need fewer calories, a higher proportion of high quality protein together with the vitamins associated with this protein. Data are badly needed to substantiate this. It seems likely, also, that older people may require a somewhat different kind of food than the younger adult. Not only different in nutrient composition, but also prepared to suit the altered physiology of the aged better. Here is a wide field of study. Now suppose we were able to meet the estimated requirements for food. There are other factors which may serve to limit the effectiveness of the nutrition we are providing. These conditioning factors must be seriously considered.

The motivation to eat is often decreased with advancing years. Perhaps if these people had a more important place in life, that is, if they were needed by someone, they would have more desire for food. Next, old people often have a reduction in the taste and smell sensation and also a decrease of psychological reaction which most of us have quite naturally on seeing a thick, juicy beefsteak put down in front of us. Many people of the older age group have poor teeth, or perhaps no teeth at all with poorly fitting dentures, which may inhibit good eating. Gastric achlorhydria becomes commonplace in old age, and there is every evidence that all gastrointestinal secretions with their accompanying enzymes are reduced in amount. Digestion and absorption of nutrients thus may be impaired and inadequate. Again, more data are needed.

Next comes the problem of intermediary metabolism. Is the metabolism of nutrients the same in old age as in younger adults? There is some evidence that it is altered at least quantitatively and perhaps even qualitatively. To understand this we must consider the problem of an individual's capacity to react to his environment. Old people are different from the young, we say, in that their resiliency is diminished. For example, although pneumonia may not produce high fever and some of the other symptoms in an old person, it may lead to fatal consequences even more rapidly. The internal adjustments which keep us in a constant state within narrow limits in spite of a rapidly changing and sometimes almost severely changing environment may be called homeostatic mechanisms. These homeostatic mechanisms may be diminished in old age.

Another example: Old people in general are less able to withstand the heat and the cold. Witness the migration from the midwest to California, and even from Boston to Florida, illustrating that those with deficient homeostasis need a more constantly benign environment. May this not also be true of food? We know that old people are less able to withstand long fasting or feasting. Perhaps on a finer scale they need a much more constant food and nutrient intake. That is, most of us eat three big meals a day. Perhaps, and this is largely conjecture, old people cannot handle easily even this amount of fasting and feasting. They might be able to take care of food better were it to be given in small, frequent feedings during the waking hours. Carefully planned metabolic studies over long periods of time are necessary to learn the scientific facts about these matters.

Now in this connection, I have a suggestion to make. Would it not be interesting and useful for a team composed of say, a physician, a dietician and food technologist interested in the processing of food to conduct a study in an institution of old individuals, document their nutrition and eating habits, and then try foods of various kinds experimentally produced by new processes; that is, foods specifically for old people designed on the basis of the data obtained from the characterization of their eating habits and general nutrition. Might we not soon learn what old people will and can eat, and whether we can influence their health and happiness by altering their food intake?

For example: It is said that feeding old people is like feeding infants—that old people just must have similar kind of food properly mashed and ground up that infants are said to require. Well, there may be some truth in this, but the facts are not known. Again, old people often desire to eat less meat. We don't know why this is, whether it is good or bad, although we suspect it might not be good. Should other foods be substituted for meat? If so, what foods? What tickles the atrophied taste buds of the octogenarian? Should we prepare meat differently? Should we add milk and eggs or high quality protein cereal? What supplements are necessary? Does the food need to be partially pre-digested? These are the questions to which we need the answers, and they can be learned by a team such as that suggested above.

THE EFFECT OF NUTRITION ON AGING

We may now begin to answer the second question. What is the effect of good nutrition on aging? Now we have a different and quite distinct topic to discuss; one touched upon also by Dr. Sebrell, so that I will touch upon it only very briefly. The separation is necessary of natural senescence from the chronic diseases which so often accompany old age before we can really understand either. Diseases such as obesity, diabetes, arteriosclerosis, hypertension, and certain mental illnesses are among those which are frequently seen in old people, but there is good evidence that no one is a necessary accompaniment of the aging process itself.

These diseases are being studied extensively, as Dr. Sebrell mentioned, and it is likely that we will find that we must alter the kind and amount of food eaten in order to influence their prevention and treatment.

Certain nutritional diseases clearly are related to mental disease we know, but we know little about the psychoses of the older individual, the so-called senile psychoses. For example, it is difficult to decide how many are caused by arteriosclerosis, how many by sim-

ple senescence and how many by nutritional deficiency. In cancer, bone and joint diseases, diabetes and hypertension, nutrition, we know now, plays some part. With an increasing knowledge, it may be that nutrition will be shown to be important in the prevention and in the treatment of these conditions which so commonly accompany old age.

In summary, I have proposed that a team of research scientists composed of a physician, dietician, and food technologist working in close collaboration with a food processing company interested in the problem, with adequate psychiatric and social science aid, undertake to ascertain nutrient requirements for the aged: what kinds of food should be offered, how often food should be given, in what quantities, and how the food should be processed to offer optimum nutrition. In this way, feeding our old people should become on a firm scientific basis. We would hope in this way to make many of the aged dependents into productive and therefore happier individuals.

Finally, and most importantly, we might learn how to prevent both the development of faulty nutrition, and diseases due in part to faulty nutrition. Prevention is certainly our long time aim. Perhaps we who are interested in nutrition can contribute to one facet of knowledge to growing old gracefully.

A Study of Methods of Testing and Sampling for the Determination of Fat Content of Ground Meat[a]

D. C. KELLEY, LT. COL. V. C., R. E. GUERRANT, AND D. L. MACKINTOSH
Departments of Animal Husbandry and Chemistry, Kansas State College, Manhattan, Kansas

(Manuscript received October 27, 1953)

Rapid methods of fat determination in ground meat are reported. The results of the findings are compared to the results obtained by the standard ether extraction (AOAC) method.

The determination of the fat content of ground meat is of utmost importance to the meat packers as well as the consumer. The packer is desirous of producing a suitable product, but from an economic standpoint, anxious to use as much fat as possible and still be within requirements of the specifications set forth for the item. The consumer wants the ground meat component of his ration to be palatable, and not unduly wasteful. The fat content is one of the most important constituents determining this factor.

The method for determining the fat content of meats must meet the following requirements to be feasible both to the packer and the inspector:

a. The method of sampling must be such as to be representative of the product as a whole.
b. The method of determination must be accurate.
c. The results of the tests must be determined rapidly.
d. Procedure must be as simple as possible.

The determination of the fat content of meat and meat products by ether extraction was first recorded by the Association of Official Agricultural Chemists *(3)* in 1901.

Wiley *(10)* states there are some fats both in animal and vegetable substances that are insoluble in ether, but they exist in minute quantities. There are also minute quantities of bodies not fat in foods, soluble in ether and these are included in the ether extract. These solubility deviations may have a slight bearing on the accuracy of the ether extraction method of fat determination as set forth by the Association of Official Agricultural Chemists.

The method of testing for the amount of fat in ground meat by the Armed Forces as set forth in TB Med 233 (AFM 160-41) *(5)* has slightly modified the method of the Official Agricultural Chemists.

To meet the need for a rapid method of fat analysis, the laboratories of the meat packing plants and other personnel in laboratories interested in food inspection and research have devised several methods. Oesting and Kaufman *(8)* described a rapid method used for the control of manufacturing operations. Swift and Company Research Laboratories *(9)* devised a method of rapid determination of fat in meat and meat products using hydrochloric acid in distilled water for digestion of the meat. Armour and Company Laboratories *(1)* described a method used, on a tentative basis, as a control method in their processing operation. In research work conducted by Hall *(7)*, a rapid method of fat determination of ground meat has been used wherein the sample was digested with glacial acetic acid and concentrated sulphuric acid and centrifuged in a Babcock bottle. The Army Medical Service Graduate School *(2)* used a method utilizing a Paley Cheese Babcock bottle. The Depot Veterinarian, Chicago Quartermaster Depot *(6)*, was checking a method in which the ground meat was digested in a pyrex Erlenmeyer flask and the fat content measured on a 15 cc. tube attached to the flask, without centrifuging.

METHODS AND PROCEDURES

Three different groups of tests were conducted. The methods of obtaining and handling the samples used in the tests varied, in some respects, from group to group. All samples were run in duplicate.

[a] Contribution No. 199, Department of Animal Husbandry, and No. 492, Department of Chemistry, Agricultural Experiment Station, Kansas State College.

Methods of testing.

a. Ether extraction (Method of Official Analysis of the Association of Agricultural Chemists).

b. Method for fat determination of ground meat *without* centrifuging using *sulphuric acid.* (The apparatus is shown in Figure 1.)

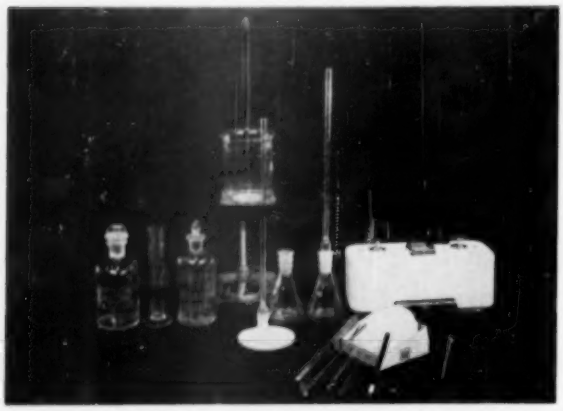


Figure 1. Apparatus for fat determination of ground meat without centrifuging using sulphuric acid.

Ten-gram samples were placed in Pyrex extraction Erlenmeyer flask and thoroughly dispersed in 10 ml. of water (70° C.) with aid of glass stirring rod; 5 ml. concentrated acetic acid was added and then 25 ml. concentrated sulphuric. The Erlenmeyer flask was gently rotated and shaken to aid in digestion of the ground meat. Complete digestion occurred in two to three minutes after addition of concentrated sulphuric acid. Warm water (70° C.) was added to bring the level of the contents up even with the lower edge of the ground glass neck. The measuring tube was placed into position and the surface brought to the top of the scale marked on the tube, by further addition of warm water (70° C.).

The fat column moved up into the measuring tube and was measured by reading from lower level of top meniscus to lower level of bottom meniscus. Figure 2.

The percentage of fat present in the sample was calculated by multiplying the number of milliliters occupied by

$$8.95. \quad \frac{\text{ml.} \times .895 \text{ (sp.gr.)}}{10 \text{ g.}} \times 100 = \text{percentage.}$$

c. Rapid method of fat determination *without* centrifuging using *Minnesota reagent,* which is composed of sodium salicylate, potassium carbonate, sodium hydroxide, and isopropyl alcohol. The apparatus and procedure were the same as were previously described for the method for rapid fat determination of ground meat *without* centrifuging, except that 25 ml. of *Minnesota reagent* was used in lieu of the acetic and sulphuric acid. The flask was also heated for 15 to 20 minutes to aid in digestion of the meat.

d. Modified Babcock method of fat determination *with* centrifuging using sulphuric acid.

A 9-gram sample of ground meat was placed in Paley bottle to which was added 5 ml. of water (70° C.). Sample was thoroughly dispersed in water with aid of glass stirring rod and 5 ml. of acetic acid was added, then 15 ml. of sulphuric acid. By mixing and stirring digestion occurred in about 2 to 3 minutes.

After securing the stopper in the Paley bottle, it was centrifuged for 5 minutes at approximately 1000 r.p.m. Bottle was placed in a water bath (70° C.) for two minutes, and hot water (70° C.) added to bring the surface of the contents up near the top of the graduation on the stem.

The bottle was centrifuged for 2 minutes at approximately 800 r.p.m., and again tempered in water bath (70° C.) for 2 minutes.

The percentage of fat in the sample was determined by reading from the bottom of top meniscus to bottom of lower meniscus (Figure 3).

e. Modified Babcock method *with centrifuging using Minnesota reagent.*

The procedure was the same as was previously described for modified Babcock method of fat determination with centrifuging except 15 ml. of *Minnesota reagent* was used in lieu of acetic and sulphuric acid, and sample heated for 15 to 20 minutes to aid digestion.

Group A:

The samples used were prepared by using ground beef with which different amounts of beef fat were incorporated with thorough mixing. Series of samples were prepared in duplicate; quarter-pound samples were wrapped in wet wax paper and frozen at 0° F., and held for approximately 3 weeks until used for the test.

Methods used:

a. Ether extraction (A.O.A.C.)

b. Rapid method *without* centrifuging using *Minnesota reagent.*

c. Modified Babcock method *with* centrifuging using *Minnesota reagent.*

Figure 2. Fat column in measuring tube. No. 1, using Minnesota reagent; No. 2, using sulphuric acid.

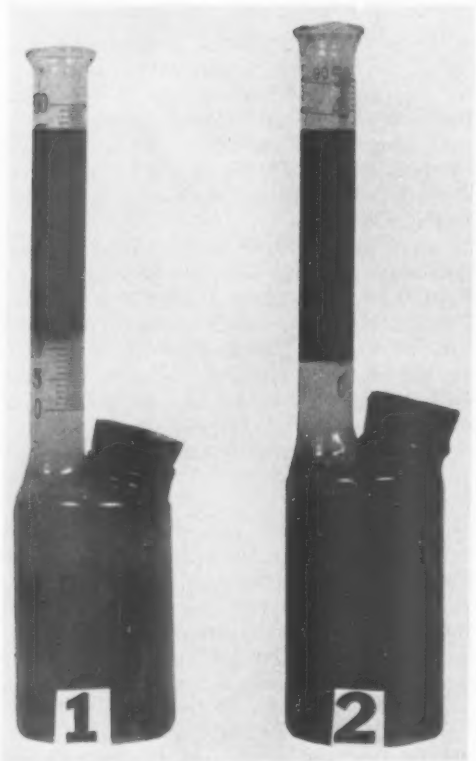


Figure 3. Fat column in stem of Paley test tube. No. 1, using Minnesota reagent; No. 2, using sulphuric acid.

Group B:

Method of sampling was similar to the method used for group A except some of the meat tested was ground and mixed three times, and a portion ground and mixed five times. The grinding and mixing was accomplished by passing through a small hand grinder using varied sizes of plates, down to one sixteenth of an inch, then blending and mixing after each operation.

Methods used:

a. Ether extraction (A.O.A.C.)

b. Rapid method without centrifuging using *sulphuric acid.*

c. Modified Babcock method with centrifuging using *sulphuric acid.*

Group C:

All of the samples used in this group of tests were seasoned pork sausage.

Methods used.

The ether extraction (A.O.A.C.) method and the modified Babcock method *with centrifuging* (using sulphuric acid), as used for the Group B series of tests.

OBSERVATION AND DISCUSSION

In Table 1, 2, and 3 is recorded the percent of fat found in the duplicate samples, using different methods of testing.

The tables and statistical analysis of results show a comparison between the standard ether extraction (A.O.A.C.) method and other methods of fat determination in ground meat, based on duplicate samples.

It is desired to state that Army area laboratories, when conducting duplicate samples with the ether extraction method, do not permit duplicate determination to exceed .5% in variation. In fact such variation seldom exceeds .2%.

For the purpose of this study a wider variation in duplicate results in the ether extraction method was considered acceptable by the authors.

In the Group A series of samples when the *Minnesota reagent* was used the results showed the following by statistical analysis as compared with the standard ether extraction (A.O.A.C.) method.

a. There was a significant difference in 100% of tests checked between the ether extraction (A.O.A.C.)

TABLE 1

Results of tests conducted on Group A series of samples

Sample series	Ether extraction (A.O.A.C.)	W/O centrifuging using Minnesota reagent	Modified Babcock using Minnesota reagent
	Percent fat	*Percent fat*	*Percent fat*
1	37.35	32.22	20.00
1	35.35	32.22	20.00
2	35.23	20.58	27.00
2	35.71	20.58	27.50
3	27.15	19.67	27.00
3	26.45	20.58	27.00
4	27.32	26.85	31.50
4	35.01	27.74	31.50
5	33.75	20.58	22.00
5	33.70	20.58	22.00

TABLE 2

Results of tests conducted on Group B series of samples

Sample series	Ether extraction (A.O.A.C.) 1	W/O centrifuging using sulfuric acid 2	Modified Babcock using sulfuric acid 3
	Samples Ground and Mixed Five Times		
	Percent fat	*Percent fat*	*Percent fat*
6	25.20	22.37	25.40
6	24.90	23.27	25.10
7	34.10	33.11	34.50
7	34.30	33.11	34.50
8	36.80	33.11	36.60
8	36.80	31.32	36.60
9	27.10	25.00	25.50
9	26.90	25.50	25.50
10	38.96	33.01	38.90
10	38.96	33.01	38.60
11	38.96	34.90	38.90
11	39.97	37.59	39.90
12	43.10	41.17	43.00
12	43.10	41.61	43.00
13	44.60	44.75	45.50
13	45.70	43.85	44.00
14	45.90	42.06	47.10
14	47.30	42.51	45.20
15	40.60	38.03	39.80
15	41.30	41.17	40.50
16	48.70	44.75	47.50
16	49.50	42.06	47.00
17	38.20	38.93	41.00
17	39.10	38.03	41.00
	Samples Ground and Mixed Three Times		
	Percent fat	*Percent fat*	*Percent fat*
18	29.90	27.74	25.50
18	30.20	27.74	25.80
19	40.50	41.17	44.00
19	40.50	41.17	42.57
20	38.20	38.48	38.40
20	37.40	38.48	38.40
21	43.70	46.54	49.40
21	44.00	42.51	46.60
22	38.40	41.17	42.00
22	38.40	42.51	42.17
23	37.70	38.03	39.10
23	37.70	38.48	39.10
24	37.00	46.54	47.40
24	37.00	46.98	47.40
25	37.90	39.38	39.00
25	39.40	40.27	39.50

TABLE 3
Results of tests conducted on Group C series of samples

Sample series	Ether extraction (A.O.A.C.)	Modified Babcock using sulfuric acid
	Percent fat	*Percent fat*
26	31.70	31.10
26	31.60	30.00
27	30.80	34.50
27	30.90	33.50
28	32.10	32.40
28	32.10	31.40
29	26.50	31.40
29	26.80	33.50
30	35.00	34.90
30	35.00	35.00
31	45.80	43.10
31	45.90	43.90
32	39.60	39.80
32	39.30	38.10
33	37.90	36.50
33	38.00	36.50
34	47.80	36.10
34	47.90	36.00
35	30.30	29.50
35	30.30	29.90
36	28.70	29.50
36	29.10	29.50

method and method *without* centrifuging using *Minnesota reagent*.

b. There was a significant difference in 80% of tests using modified Babcock method with *Minnesota reagent* and centrifuging, compared with the ether extraction (A.O.A.C.) method.

In the Group B series of tests, statistical analysis demonstrated the following differences between methods, using a varied mixing procedure:

1. Samples mixed 5 times.
   a. There was a significant difference in 91% of tests using *sulphuric acid without* centrifuging compared with ether extraction (A.O.A.C.) method.
   b. There was a significant difference in .08% of tests by the modified Babcock method using *sulphuric acid* and *centrifuging* compared with the ether extraction (A.O.A.C.) method.
2. Samples mixed 3 times.
   a. There was significant difference in 37% of tests using *sulphuric acid without centrifuging* compared with the ether extraction (A.O.A.C.) method.
   b. There was significant difference in 75% of tests by the modified Babcock method, using *sulphuric acid* and *centrifuging* compared with the ether extraction (A.O.A.C.) method.

In Group C series of tests all samples were pork sausage which had been seasoned, which made the reading of the fat column in the Paley test tube difficult to determine because the seasoning collects at the bottom of the fat in the tube. By statistical analysis 54% of the tests showed significant differences between the ether extraction (A.O.A.C.) method and the modified Babcock method using *sulphuric acid* and *centrifuging*.

SUMMARY AND CONCLUSION

On the basis of the findings of results, in the tests conducted, the following conclusions can be made:

The results obtained from (a) the Modified Babcock method of rapid fat determination, using sulphuric acid with centrifuging, and those from (b) the ether extraction method, compared closely (significant difference in .08% of tests) when the samples were ground and mixed five times.

The rapid method of fat determination *without* centrifuging after digestion with *sulphuric acid* was not a satisfactory method of fat determination in ground meat. The results vary from results obtained by the ether extraction (A.O.A.C.) method.

The use of the *Minnesota reagent* in the Modified Babcock method *with centrifuging* and the rapid method of fat determination *without centrifuging* is not satisfactory because of variable results and inability to bring about complete disintegration of the tissues and release of all the fats.

Complete mixing and grinding of the samples is essential in order to get as representative a sample as possible for testing, regardless of the method employed.

Seasoning added to pork sausage interferes with the accuracy of the fat determination by the Modified Babcock method. The lower meniscus of the fat column in the neck of the Paley test tube is not distinct for reading.

LITERATURE CITED

1. Armour and Company Laboratories. *Rapid Control Method for the Determination of Fat in Cooked and Uncooked Sausage and Ground Meat such as Hamburger (Tentative)*. Kansas City, Kansas, February 6, 1951. (Unpublished.)
2. Army Medical Service Graduate School, Army Medical Center. *Rapid Method for Fat Determination in Ground Meat*. (Unpublished.) Veterinary Division, Army Medical Service Graduate School Army Medical Center, Washington, D. C., October, 1951.
3. Association of Official Agricultural Chemists. *Methods of Analysis*. 1950, Association of Official Agricultural Chemists, Washington, D. C.
4. Bureau of Agricultural and Industrial Chemistry, U. S. Dept. of Agriculture. Food analysis. *Bulletin 65*, Washington, D. C., 1902.
5. Department of the Army *Technical Bulletin TB Med 233* (Department of the Air Force Manual AFM 160-41). Veterinary laboratory service (food analysis). Department of the Army and Air Force. 1950.
6. Depot Veterinarian's Office, Chicago Quartermaster Depot. *New Method for Fat Determination of Ground Meat*. (Unpublished.)
7. Hall, J. Lowe. *Babcock Method for Determining Fat in Meat Products*. (Unpublished.) Kansas State College, Manhattan, Kansas, October, 1951.
8. Oesting, R. B., and Kaufman, I. P. Rapid determination of fat in meat and meat products. *Ind. Eng. Chem. Anal. Ed.*, **17**, 125 (1945).
9. Swift and Company Research Laboratories. *Fat Meat and Meat Products, Using Babcock Bottles—Method Ca4C-49* (Unpublished.) Chicago, Illinois, January, 1952.
10. Wiley, Harvey W. *Foods and Their Adulteration*. 1907, P. Blakiston's Son and Company, Philadelphia, Pennsylvania.

Trends in the Development of Foods for the Upper-Age Groups[a]

L. E. CLIFCORN AND G. T. PETERSON
Research Division, Continental Can Company, Chicago

(Manuscript received October 29, 1953)

Investigation of this subject in the food industry has revealed that there is no established trend for foods for this specific usage, outside of the increased uses of low-sodium foods for high blood pressure and cardiovascular disturbances and the low-calorie foods for body weight control and use by diabetics. The latter are foods for the treatment or control of specific abnormalities. When we think of the upper-age or old-age classes, the question arises as to whether we have need for a class of foods which might extend health, enjoyment of life, and useful years beyond that readily attainable by use of foods in regular distribution channels today. To those in the food industry who have been thinking about this problem, the need for geriatric foods must be more clearly defined in terms of specific foods for this age bracket, their texture and nutrient content, package size, cost, and potential market. Since we cannot discuss an established trend, we would, therefore, like to review the problem as to whether or not there is a necessity for such a trend for geriatric foods in the near future.

Dr. W. H. Sebrell *(9)*, Director of the National Institutes of Health, U. S. Public Health Service, in a recent article on "Improved Public Health Through Better Nutrition," stated: "It is interesting to note the extent to which the lengthening of the average life span is changing the composition of our population. In 1935 the United States had slightly less than 8 million people 65 years of age and over. By 1950, this age group had increased to more than 12 million. By 1960 the figure is expected to exceed 14.5 million, and by 1975 the 65-and-over-group will total almost 20 million *(8)*.

"When we compare these increases with those of the total population, we find that the old-age group will show an increase of 156% between 1935 and 1975, compared with a 45% increase in the total population. I think you will agree that this is a rather striking trend of great significance.

"A comparison of the life expectancy of the middle-aged American today with that of a century ago further emphasizes the need for attention to the health problems of the aged. As I have indicated, the past century has seen an increase of about 30 years in the average total life span. A 50-year-old man today, however, may expect to live only 23 years—a year and a half more than in 1850." In essence the overall gain in health in the past 30 years has been against diseases of the young, but older people are nearly as vulnerable to the chronic diseases as they were 100 years ago.

In Dr. Sebrell's last statement we find the challenge. The nutritional problems concerning our old-age groups will grow in importance in the years ahead. It is rather startling to note that of the five top causes of death, the first four are classed as degenerative or metabolic diseases. As ably stated by Dr. C. G. King *(7)*, Scientific Director of the Nutrition Foundation, "one cannot attribute all of the top ranking diseases to malnutrition as a sole cause, but nearly all research men do agree that nutrition plays an important, and often a dominant role, in all of them."

Dr. King further stated that "a point overlooked in relationship to our aging population and the trend toward less physical work for all persons, is the fact that our bodies require a better diet in these modern days than ever before. The need for vitamins, minerals, and protein does not drop sharply, like the decreased need for calories, when little physical work is done. The result is a true psychological need for food of higher nutritive quality per thousand calories."

Regarding nutritional problems concerning old-age groups, Dr. Sebrell asserted that these were of special interest in view of the age-associated changes affecting food intake and metabolism. He has in mind here limitations of digestion and circulation, dental problems, emotional factors, poor eating habits, and so forth. In addition, defective absorption or utilization may increase the need for such nutrients as calcium, iron, and protein. He believes that these problems suggest the need for more research into the nutritional requirements of the aged, with attention to upper as well as lower limits, and that there is a need to study means for preventing metabolic derangements, some of which are undoubtedly related to the extensive hormone changes which occur with advancing age *(9)*.

The importance of safeguarding the broad nutritional advances made in the last quarter century must be emphasized. These gains must not be taken for granted, particularly by the food industry and the public. We need to continue our efforts to improve both our foods and our dietary habits. Despite the improved nutritional status achieved in recent years, many of our people may still be in a borderline category with respect to nutrition. Their intake of certain nutrients, while sufficient to prevent overt deficiencies, may provide only a scant margin of safety in their tissue stores to resist stress stemming from disease or temporary imbalance in their diets. Any significant regression in the average American diet might cancel out many of our gains.

The relationship of fat in our diets to the degenerative diseases is tremendously important in our consideration of geriatric foods. Ancel Keys reported some interesting work with respect to the diet and heart disease *(5)* and the relationship of concentrations of cholesterol in the blood to the development of heart diseases. It is suggested that our present plight with coronary disease is related to the fact that in the American diet, the propor-

[a] The subject of trends in the development of foods for the upper-age groups, with particular interest as to what is being done in the food industry, was investigated by the authors. These findings were presented as part of a symposium on "Dietary Problems of an Aging Population" at the National Meeting of the Institute of Food Technology in Boston on June 22, 1953.

tion of the total calories contributed by fats and oils has steadily risen since 1910 from around 30% to well over 40%. Contrast this with Italian diets which provide about 20% of their calories in the form of extractable fats and oils and Japan with less than 10% fat calories, where coronary heart disease is relatively rare *(5)*.

The rise in fat consumption has taken the place of a corresponding amount of carbohydrates while the proportion of proteins in the diet has remained substantially constant. This brings up the question as to where we get the fats in our present high fat diet. Of our current fat intake, approximately 45% comes from cooking and salad fats and oils excluding butter or margarine. A little more than 20% comes from meats, fish and poultry, and little less than 20% comes from dairy products, excluding butter. About 4% comes from eggs, about 3% from butter, and the balance of 8% from cereals and grains, nuts, fruits, and vegetables. We should consider this list and the facts presented here. Obviously, the consumption of high quality foods should not be reduced, but the possible danger of a high fat diet for men in the thirties and beyond cannot be ignored. Here is a challenge not only for the men but even more for their wives, for the dietitians, and for the physicians upon whose advice they rely *(5)*.

UNDERSTANDING THE OLDER PERSON IS ESSENTIAL TO SOLVING THE PROBLEM

In the discussion thus far, we have established the size of the population group with which we are dealing and some of the general nutritional considerations for geriatric foods. We must by all means become thoroughly acquainted with the "old folks" who may consume the new foods that we are trying to define and evaluate. Older persons usually have fixed food likes and dislikes, and find it difficult to change their eating habits or acquire desires and tastes for new and different foods. Psychological attitudes prevail which often eliminate certain foods from their consideration. Elderly people, as a rule, do not like to be reminded of their age or their infirmities and prefer to eat, within their capabilities, the same foods they have been accustomed to eating in earlier years. The loss of teeth, lack of good dentures, and poor digestion also affect food habits greatly in later years. In addition, one out of four suffer at age 60 from achlorhydria, and by age 70, the percentage has risen to one-third *(1)*. These chronic disorders and others tend to promote malnutrition, particularly by restricting the choice of foods. Elderly persons living with their immediate families are usually required to eat food prepared for those of younger years. If they live alone they often tend to eat improperly as a result of a number of things: e.g., lonesomeness, money, problems, loss of objectivity of life, etc. The ease of preparation and availability often dominate food selection, with resulting neglect of nutritional requirements. Also, the economic status of the individual will dictate to what lengths he may go in selecting an adequate diet. More than two million old people are receiving old age assistance, the average value of which is only $38 per month *(1)*. At the present time, living on such a sum means the most rigid economy in housing and eating; many are living in a single room without cooking facilities. They are usually unfamiliar with the fundamental principles of nutrition and since their diet must be cheap, it contains a high percentage of carbohydrates.

Ancel Keys suggests that in old age, as at other ages, nutrition education is the most reliable way of assuring good nutrition *(6)*. For older people who care for themselves, nutritional education cannot be stressed too much. Their knowledge about diet and nutrition often lags far behind that of their younger contemporaries. Keys believes that emphasis should be placed on practical matters, but that the reasons behind nutrition and diet advice should be explained to the old person. Some of the important points he suggests are as follows:

a. A good diet is just as important in old age as in youth.
b. Overeating is more dangerous for the old than for the young.
c. Older people should be sparing in the use of all fats and oils and should avoid cooking in fat.
d. The simplest way to assure adequacy of proteins, vitamins, and minerals is to use a varied diet.
e. Liberal use of leafy and root vegetables, fruits, and coarse cereals will help control constipation.
f. Bread enriched with milk solids and vitamins is desirable.
g. There should be an abundant fluid intake, and this may include moderate amounts of coffee, tea, and alcoholic beverages.
h. Meat, fish, or eggs every day should be the rule.
i. Special food concentrates and nostrums are seldom necessary. Peculiar and fancy diets should be avoided.
j. Moderate limitation in the use of table or cooking salt is wise.

With regard to these diet recommendations, it should be emphasized that they should be started in early years with the objective of lengthening the years of useful life. Too many people abuse themselves with their eating habits and reform too late to do much good.

THE SITUATION REGARDING SPECIAL FOODS FOR OLDER PEOPLE

At the present time there are few special foods being manufactured and designated for use by older people. Some dried milk products have been specially prepared and marketed as geriatric foods. Certain bread formulations supplemented with added protein have been prepared and used at the Elgin, Illinois, State Hospital *(4)*. Low-sodium foods and low-calorie foods are designed mainly for the needs of those in the upper-age and old-age brackets. Formulated foods, specifically for this segment of our population, have not been ventured.

The production and marketing of dependable dietetic foods represents an obligation assumed by the food industry in response to a demand of the medical and dietetic professions. From the practical point of view, we know that the demand for dietetic foods is large and that it will grow larger in the future. The life span is increasing, and few people in the upper-age brackets can

afford to be indifferent to the quality of the foods and beverages they consume.

The food manufacturer can be assured that not only does a demand for dietetic foods exist—a demand that will increase—but also that the production of dependable products affords business opportunities to the small food concerns as well as to the large ones. In 1949, a census was taken of canners of dietetic canned foods and the products packed by them. The returns then showed 17 packers and 33 products. In 1951, there were 85 canners and 53 products with an estimated pack of 5,000,000 cases of canned dietetic foods for the year *(2)*. A survey being conducted at this time, and as yet incomplete, shows 57 products in the low-sodium class alone (the number of packers yet undetermined) and an estimated pack of low-sodium foods of well over 10,000,000 cases. There is a great trend toward water-packed fruits. One large packer produces only water packed fruits, properly labelled for special dietetic use, and another large packer plans to pack a million cases of artificially sweetened canned fruits.

We feel confident that the food industry has the right philosophy on dietetic canned foods. The industry realizes that these special foods are used for feeding the sick or others who would not otherwise be in good health if their diets were not controlled. They also realize that there is an obligation on the part of the American food industry to see that the unfortunate are not exploited.

Dr. A. R. Colwell claims that there is no absolute need for artificially sweetened foods for diabetics *(3)*. They are a concession to the patient, in some instances, to provide psychological satisfaction. In this class are fruits, jellies, soft drinks, and gelatin desserts packed with artificial sweeteners. Even though these artificial sweeteners are not harmful to diabetics, the medical profession recommends that the patient first be self-trained to like foods that are not sweetened. However, because of the harmlessness and definite psychological advantages, the medical profession is sanctioning the production and use of artificially sweetened foods.

Although the cost of using artificial sweeteners in canned fruits is no higher than with sugar, from the producers' standpoint, it costs more to produce these special dietetic foods for three reasons: (a) necessity for special production control and analysis; (b) smaller volume packs in many instances, and (c) special distribution. However, competition and the good old American system should bring these foods down to a price margin very slightly over that of conventional packs.

At a recent AMA conference on non-food additives, the question was raised as to "What should be done about the rest of the family when one member is on a special diet. Should they also be constricted to low-sodium or low-calorie diets?" This thinking has a great deal to do with package sizes and will tend to keep packages for special dietary foods in smaller sizes.

One of the great concerns of the canning industry was to get special dietetic canned foods out of the novelty or "racket" class. As a result we now see them in our regular grocery stores and that is where they should be. Since several states insist that dietetic foods be sold from one department, most chain stores now have a dietetic food section where more than one brand of low-sodium or low-calorie foods are shown.

It has been brought to our attention that in St. Petersburg, Florida (a haven for the aged), relatively large amounts of baby foods are sold in proportion to the baby population. Apparently a good many elderly persons are buying baby foods for their own consumption. But if these same baby foods were packaged in slightly larger cans and labelled "Geriatric Foods" or "Foods for the Aged," they probably would not sell. The old people would be embarrassed to be seen reaching for them in stores. Nevertheless, if the package had a descriptive label which clearly described the contents of the container and its specific usage, then we are sure that there would be a good market for these products. Pureed vegetables and fruits, packed in the 303 can size, would better meet the needs of the older person and at a saving over the smaller cans. Consideration might also be given to chopped foods and specially formulated stews.

Generally speaking, good nutrition and good diets for younger persons also meet the needs of the upper-age brackets, until some abnormalities manifest themselves. At all ages a good diet will help to avert these abnormalities and extend the useful years of life. A few years ago one had to be well-to-do in order to live on a restricted diet, but thanks to the efforts of the food industry, this is not the case today. Low-sodium and low-calorie foods are available for diet management of many of the abnormalities of the upper-age class. However, some consideration might be given to specially textured foods, packed in medium can sizes, to meet the physical and digestive food demands of many old people.

Beyond these conclusions, it is our recommendation that the National Research Council, the National Institutes of Health, the Nutrition Foundation Inc., and the American Medical Association continue to study the problem of geriatric foods and make recommendations to the food industry as to what could be produced to benefit this class of our population. When such recommendations are available you may be sure that the food industry will respond in true spirit of public interest. Until then, the best that can be done is to meet the demand by the careful production and labelling of low-sodium and low-calorie foods, to be sold at an economical price.

LITERATURE CITED

1. Blanck, F. C., and Wooster, Jr., H. A. Editor, *Nutritional Observatory*, **9**, 74 (October, 1948).
2. Bing, Franklin C. Editor, *Dietetic Canned Foods*, National Canners Association, Washington, D. C. (1953).
3. Colwell, A. R. (Unpublished report to Council on Foods, American Medical Association, April 9, 1953).
4. Horwitz, M. K. Dietary requirements of the aged. *J. Am. Dietet. Assoc.*, **29**, 443 (1953).
5. Keyes, Ancel. The diet and heart disease. *Food and Nutrition News*. (National Live Stock and Meat Board), **24**, 1 (1953).
6. Keyes, Ancel. *Nutrition for the Later Years of Life*. Public Health *Reports*, **67**, 484-489 (1952).
7. King, C. Glen. *Food For Your Later Years*. Paper prepared for the Joint Legislative Committee on Problems of Aging. December 11, 1952.
8. Perrott, C. St. J., Ciocco, A., Baehr, G., Rosenfeld, L. S. Illness and Health Services in an Aging Population, PHS Publication No. 170, 11-23 (1952).
9. Sebrell, Jr., W. H. Improved Public Health Through Better Nutrition. *J. Agri. Food Chem.*, **1**, 364-368 (1953).

A Simple Bacteriological Medium for the Growth and Isolation of Spoilage Organisms from Canned Foods

J. F. FOLINAZZO AND V. S. TROY
Research Division, Continental Can Company, Inc., Chicago, Illinois

(Manuscript received March 6, 1954)

Various canned food products were examined to evaluate a new medium for the growth and isolation of spoilage organisms from canned foods. This medium was compared with other media normally employed for this purpose. The results of these studies are presented.

Bacterial spoilage of canned food may be the result of underprocessing, elevated storage temperatures, or leakage of the container resulting from improper closure, rough handling, or a defect in manufacture. The organisms normally associated with spoilage due to underprocessing are heat resistant, spore forming bacilli which survive the process and subsequently grow, while those associated with spoilage due to leakage are chiefly cocci and other non-sporulating types of low heat resistance which could not have survived the process and must, therefore, have entered the can after processing. Spoilage due to the growth of thermophilic organisms, which are also heat resistant, results from inadequate cooling of the processed product and/or storage of the canned product at elevated temperatures. The normal commercial process is not designed to completely destroy the spores of all obligate thermophilic organisms.

To accurately determine the cause of spoilage of canned food, it is essential that satisfactory media be employed for the bacteriological examination. Such media should contain factors necessary for the optimum growth of food spoilage organisms.

In 1950, Dr. Clarence F. Schmidt of our Research Division developed a simple, inexpensive medium consisting of dried peas and peptone solution, designated as PE-2, which appeared to be favorable for the growth and isolation of both aerobes and anaerobes. Experiments were conducted to evaluate this medium and to compare it with other media used by our laboratory for the bacteriological examination of canned foods to determine the cause of spoilage. These media included dextrose broth for the growth of aerobes, TA-PA medium for the growth of anaerobes, and tomato liver agar for the examination of tomato products for both aerobes and anaerobes.

PROCEDURE AND MEDIA FORMULAE

Screw cap tubes (20 x 150 mm.) containing the medium were inoculated with approximately 0.5 ml. of the spoiled canned product. Duplicate tubes were incubated at 30° C., 37° C., and 55° C.—depending upon the type of spoilage organisms suspected—for a minimum of 2 days and a maximum of 5 days. The tubes were examined and the results recorded.

PE-2 medium. Add 12 dried, small Alaska seed peas and approximately 20 ml. of a 2% peptone solution to 20 x 150 mm. screw cap tubes. Sterilize in autoclave 15 minutes at 15 pounds pressure (250° F.). The pH of the medium is approximately 6.5—no adjustment necessary.

Dextrose broth. Dissolve 8 g. nutrient broth (Bacto), 15 g. dextrose (Bacto), and 5 g. yeast extract (Bacto) in 1,000 ml. of distilled water and add 4 ml. of a 1% solution of Brom Cresol purple indicator. Adjust to pH 6.2. Tube and sterilize in autoclave 15 minutes at 15 pounds pressure (250° F.).

TA-PA medium. Dissolve 10 g. Tryptone (Bacto), 5 g. dextrose (Bacto), 1 g. yeast extract (Bacto), 1.25 g. K_2HPO_4, 10 g. Agar (Bacto), and 1 g. soluble starch in 1,000 ml. of distilled water and adjust to pH 6.8. Tube and sterilize in autoclave 15 minutes at 15 pounds pressure (250° F.).

Tomato liver agar. Dissolve 10 g. of tryptone (Bacto), 5 g. lactose, 5 g. dextrose, 5 g. yeast extract (Bacto), 1 g. K_2HPO_4, and 20 g. Bacto-Agar in 800 ml. of distilled water to which 100 ml. of canned tomato juice and 100 ml. of liver broth have been added. The pH of the medium is approximately 5.0—no adjustment is necessary. Dispense into tubes. In tubing, one-half inch to one inch of boiled ground liver is introduced into each tube before adding the melted medium. Sterilize in autoclave 15 minutes at 15 pounds pressure (250° F.).

Liver broth. Mix 500 g. of ground beef liver, from which the fat has been removed, with 1,000 ml. of water and boil slowly for one hour. Press the boiled material through cheese cloth and make up the volume of liquid to 1,000 ml. Add 10 g. tryptone and 1 g. K_2HPO_4 to the broth and adjust to pH 7.0. It is advisable to save the boiled ground liver by spreading in a thin layer and drying thoroughly at 100-135° F. When dry, it may be kept indefinitely and used for tubing with a stock supply of liver broth.

RESULTS AND DISCUSSION

Data obtained from the experiments conducted to evaluate these media are summarized in Tables 1 and 2. These results show that the PE-2 medium gave the highest percentage of positive tubes for the growth of microorganisms associated with spoilage due to leakage, underprocessing, and thermophilic organisms, and indicate that it is the best of the four media compared in

TABLE 1

Comparison of media used for the growth of spoilage organisms from low-acid canned foods.

Media	Leakage organisms			Underprocessing organisms			Thermophilic gas forming anaerobes		
	Number of tubes		% Positive	Number of tubes		% Positive	Number of tubes		% Positive
	Positive	Negative		Positive	Negative		Positive	Negative	
Dextrose broth	127	33	78	15	18	45	0	29	0
TA-PA medium	27	56	33	11	5	69	15	14	52
PE-2 medium	132	30	82	33	0	100	20	9	69

these studies. In addition, PE-2 medium is easy to prepare and costs much less than other media normally employed for this purpose.

TABLE 2
Comparison of media used for the growth of gas-producing organisms from canned tomato products

Media	Number of tubes		% Positive
	Positive	Negative	
Dextrose broth	39	6	87
Tomato Liver Agar	26	8	77
PE-2 medium	42	3	94

During the past year, this laboratory has used the PE-2 medium almost exclusively for spoilage examinations of canned foods. It has been used successfully for the preparation of spore suspensions of putrefactive anaerobes, thermophilic anaerobes, and butyric anaerobes. It has also been used by other laboratories for the growth and isolation of spoilage organisms from canned foods with indications of equally favorable results.

SUMMARY

PE-2, a new, simple, inexpensive bacteriological medium, was evaluated and compared with other media commonly employed for bacteriological examinations of canned foods to determine the cause of spoilage. The PE-2 medium was found to provide excellent growth factors necessary for the optimum growth of food spoilage organisms. The results of comparative studies indicate that the PE-2 medium is superior to dextrose broth, tomato liver agar, and TA-PA medium for the growth and isolation of spoilage organisms from canned foods.

Frozen Concentrated Citrus Juices — Co-Packer Quality Control[a]

H. S. MADSEN AND A. D. D'ERCOLE

Birds Eye Division, General Foods Corporation, Lakeland, Fla.

(Manuscript received June 15, 1953)

The principal considerations in establishing a dual-control method to achieve quality standards which reputable marketers desire and must maintain are presented. Applications of the dual method, i.e., control shared by processor and buyer, are described in terms of raw material, plant sanitation, spoilage control, control of separation, laboratory control, equipment design and operation. Final acceptance measurements for the finished product are discussed.

So-called co-packer relationships between producer and marketer exist in many fields of industry and, particularly, in many parts of the food business. We are concerned here with production and marketing of frozen citrus concentrates where there are only some twenty-odd prime producers and many times that number of marketers.

In general, a producing co-packer in the citrus field supplies a complete manufacturing service. He procures raw materials and packaging materials, operates a plant and stores and ships the finished product. For this he is paid a fee to cover his costs and to afford him a profit.

The marketing co-packer distributes and sells. He advertises to the consumer and the trade. He publicizes and promotes. His activities—often on a national scale—not only promote his own brand—but generate consumer interest in the product, regardless of brand.

Frozen citrus concentrates are new food items. Many variations of the general processing methods can and are applied. Variation exists in design and performance of important units of the processing line. New ideas, not all of which are sound, are tried out for the purpose of product improvement or cost reduction or both.

However, it is basic to the continued success of frozen concentrated citrus juice that it has satisfactory quality at the consumer level. To achieve the quality standards which reputable marketers wish and need to maintain, quality control procedures must be well planned and well executed. Cooperative effort by representatives of *both* seller (processor) and buyer (marketer) is the method most likely to be successful in retaining acceptance by the final arbiter—the consumer.

Written standards and objective specifications are essential to control of quality but in the food industry the subjective factors on which final judgment must be made cannot be defined in hard and fast terms. The standards for frozen concentrated orange juice as defined by the Florida Citrus Code and the U. S. Grades have wide limits within grades for certain of the measurable properties. For example: The solids-acidity ratio limits for statutory Grade A are wide. The orange peel oil level maximum for Grade A is two to two and one-half times the level most tasters prefer. The color standards for Grade A are very lenient. The total microbial population tolerance is such that incipient spoilage has been known to occur at bacterial levels well within the allowable maximum.

It is to the mutual interest of both processor and the buyer that the buyer should station qualified quality control personnel at each of his packer's plants. These people work with and share responsibility with the packer's quality control group. This system has the tremendous advantage over others in that the packer knows at the time of packing whether he is satisfying the requirements of the buyer. With taste and the consumer's viewpoint emphasized by the buyer's representatives, the subjective side of quality evaluation is given

[a] Presented at the Thirteenth Annual Meeting of the IFT, Boston, Massachusetts, June 23, 1953.

the full attention it deserves. It has been demonstrated amply that a qualified buyer's representative stationed at a packer's plant can be of invaluable service to the packer in helping him to avoid packing off-quality material while at the same time assuring his own company that requirements are being met.

MAIN PRINCIPLES OF A DUAL-CONTROL METHOD

Probably no one can be convinced by generalities alone of the soundness of the advantages of this dual-control, quality-wise, of frozen citrus production. The following specific applications of the dual method will illustrate the value of step-by-step observation of the successive production phases to lead to an acceptance of the finished product. Costly rejections of material in process or of finished product can be avoided and the packer's plant be kept in constant operation.

Raw material. The flavor of any processed food product is fundamentally dependent on the flavor and quality of the raw material. It is impossible to produce a top quality product from poor raw material. While this is usually accepted in principle, it is easily overlooked or compromised in practice. The adherence to strict raw material specifications is the master key to the production of high quality processed items.

The buyer's representative should be in a position to guide the packer's fruit procurement department in matters of variety and maturity specifications and be prepared to accept or reject borderline deliveries. Fruit should not be allowed to remain either in trucks or bins for prolonged periods but should be processed as soon as possible after picking.

Plant sanitation. A definite program for plant sanitation must be in effect. The buyer's representative should consult with and assist the packer's personnel who have responsibility for sanitation. He should be fully posted on the latest and best cleaning materials and equipment and their use for both fruit and equipment sanitizing. A cleaning and spraying program should be standard for fruit storage bins. General good housekeeping should be emphasized.

Control of spoilage. Probably the most feared hazard to quality of frozen citrus concentrates is the occurrence of what the old time canner calls "sour spoilage" caused by the presence and growth of lactobacillus-type bacteria.

Fruit is undoubtedly the source of spoilage organisms. The use of only sound fruit, application of good fruit inspection, intensive sorting for removal of bad fruit followed by adequate sterilizing of the fruit surfaces are prime considerations in the prevention of off-odor and off-flavor spoilage.

Defective fruit must be eliminated before fruit is stored in the bins. If such fruit is not sorted out, the surfaces of healthy sound fruit may become heavily contaminated and make fruit surface sterilization more difficult. Bins become infected thus contaminating succeeding loads of sound fruit.

After washing and sanitizing fruit, and immediately before extraction, a final inspection is necessary to eliminate defective fruit not previously removed.

Single strength juice must be handled as rapidly as possible. Once juice becomes infected with spoilage organisms, single strength holding tanks and evaporators become contaminated and spoilage may result through the growth of these organisms in the citrus pulp and solids adhering to the walls and surfaces which are not being continuously washed free by new product.

Extractors, juice lines, conveyor belts, finishers, and juice holding tanks should be cleaned frequently, depending on the bacteriological conditions determined by the laboratory. Buyer's representatives should be in a position to aid in the interpretation of these laboratory findings and be able to apply and translate the data into practical terms.

If juice of low bacteria count is supplied to properly operated evaporators, those machines can be maintained in a sanitary condition for longer operating periods than some other equipment in the citrus plant. Here again, management must depend on the quality control laboratory's findings. The recommendation by the qualified buyer's representative should be considered in determining the frequency of general cleanup which requires a complete plant shutdown.

In years past spoilage has occurred and those concerned were not aware that it was taking place. Considerable quantities of product which were packed in the meantime resulted in serious financial losses to both producer and marketer. This happened because laboratory methods were inadequate and some quality control people relied too confidently on their objective tests when a simple organoleptic odor test would have detected the spoilage. True, the product must already have spoiled to develop an off-odor. However, if the laboratory tests had been supplemented by properly applied and frequent organoleptic tests, the packing of gross amounts of spoiled material would have been prevented.

Recently, laboratory methods have been developed for detection and thereby the control of spoilage. The direct microscopic examination of dried smears of juice or product or use of the phase contrast microscope in qualified hands can make the estimation of the population of spoilage organisms possible.

In the attempt to provide a yardstick by which the soundness of frozen concentrate can be measured, from the microbial point of view, numerical standards of total organism count have been established. Every effort, however, should be made to pack product with the lowest microbial population possible. It is not enough to produce product with no evidence of typical spoilage flavor. Considerable information is at hand indicating that material with a low microbial population has superior original flavor and better storage life than product having a high count. Product with low flavor characteristics, although lacking definite off-odors, is often found to have very high microbial populations. The predominant organisms, however, were not typical of those known to have caused spoilage. These organisms may very well be responsible for flavor deterioration in storage, although it has not been proved.

The cost of producing product of low bacterial count is not out of line when one considers that the lack of proper sanitation can cause rejection of the product at the plant or loss of consumer acceptance. Either result could lead to serious financial loss.

Control of separation. Only the marketer can know, on the basis of consumer experience, what degree of separation of reconstituted frozen orange concentrate is acceptable. He then can set up performance standards to be applied by the quality control staff. He may devise routine test methods to insure adherence to these standards. These test methods, to be useful, must be able to predict at the factory level what the consumer's probable experience will be when the product has been subjected to the hazards and abuses of the trade channels and of the consumer's own handling of the product.

One such approach has been to determine the degree of separation resulting from accelerated aging. The degree of separation can then be expressed objectively in terms of an arbitrarily chosen scale denoting the turbidity of the serum layer, if any, resulting from separation under the standardized conditions applied.

In the illustrations, examples are shown of unsatisfactorily high degree of separation as compared with a satisfactorily low degree. These are shown from the consumer viewpoint in Figure 1 where the whole juice is observed. In Figure 2 these juices have been allowed to settle in cylinders for comparison. Typical results are shown in Figure 3 where, from the quality control test viewpoint, turbidity is estimated visually in a special wedge shaped cell. In this illustration a non-separated juice is

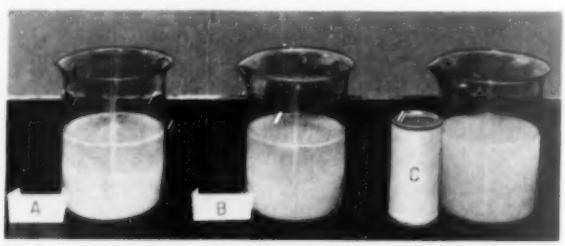


Figure 1. Orange juice serum separation as observed by the consumer compared with appearance of juice where no separation has occurred.

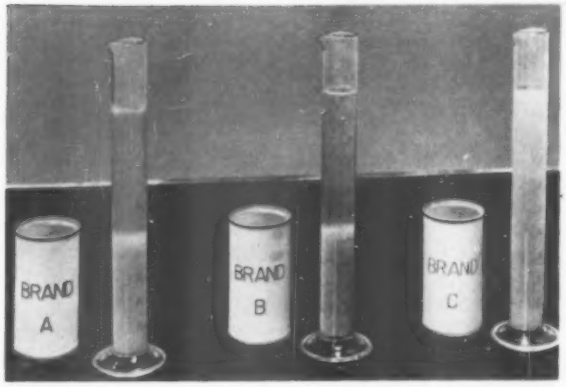


Figure 2. Orange juice shown in Figure 1 after allowing to settle in cylinders.

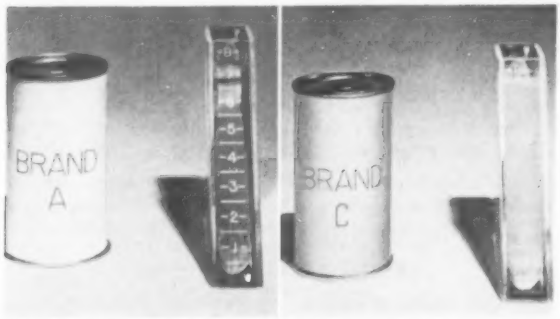


Figure 3. Visual observation of degree of separation in simple cell after samples shown in Figures 1 and 2 have been centrifuged to remove suspended insoluble solids.

observed in the right hand cell while serum from a completely separated juice is shown on the left.

Obviously, the use of such measurements as these is not only for "historical" purposes, but also to guide the use of proper processing measures and thus avoid an excessive degree of separation in the finished product.

Laboratory control. A qualified buyer's representative can render an excellent service to the packer's laboratory by helping to instruct new personnel in laboratory techniques, new tests and procedures, and in proper interpretation of results. The most exacting laboratory procedures are futile if the results are not properly interpreted and applied. This is true whether the procedure is the proper blending of fruit at the bins to obtain the desired juice Brix/acid ratio or a more elaborate test such as determination of pectin esterase.

Peel oil measurements are made at rather frequent intervals. If found not to be in the desired range, adjustments in the extracting equipment should be made immediately to provide the proper amounts. Here again, organoleptic testing, with the consumers' preferences in mind, must establish the final control.

The frequency of any laboratory determination is a matter of judgment on the part of both the packer's quality control people and the buyer's representative. The buyer's demands should not be so great as to create a burden on the packer's quality control budget by requiring personnel to run determinations that are meaningless. It is important, however, that a sufficient number of the essential objective tests are made to demonstrate to the buyer that proper control is achieved. For example, the direct microscopic count must be made frequently enough to bear an adequate relationship to variation in fruit supply, shift changes of plant operators and actual growth rate of undesirable organisms that the results can be used to determine operating practice. A reduction may be made in the frequency of the test when adequate confidence in raw material supply and operating methods has been established.

The frequency of routine tests, in general, can be determined only on the basis of experience in a given plant and with a given crew.

Equipment design and operation. Before any piece of equipment is purchased, its cost, efficiency, sanitary design, durability, and ease of operation must be considered. The simpler the equipment is in design, usually the easier it is to maintain mechanically and to keep sanitary. The larger buyers normally have competent engineering and research staffs who can be consulted on questions involving equipment selection and operation. This service is available to the packer as are other services for solution of technical problems, plant layouts, equipment redesign, and change-overs of any description.

FINAL ACCEPTANCE MEASUREMENTS

The question of finished product acceptance has been greatly facilitated if a program as outlined has been followed with both packer's and buyer's quality control people actively and cooperatively engaged in preventive quality control. This system establishes the following points to the satisfaction of both groups: The fruit used has been acceptable; it has been stored for a minimum period of time; it has been properly sorted and washed. The plant has been maintained in a sanitary manner by use of germicidal sprays and proper and frequent clean-ups. The single strength juices and intermediate products have been handled rapidly and they have been examined both by laboratory methods and organoleptic tests. The equipment has been operated properly.

The finished product should be technically sound and meet all objective tests within ranges specified as to:

(1) Finished Brix and solids-acid ratios.

(2) Peel oil levels.

(3) Total microbiological population and, further, should have a very minimum of potential spoilage organisms.

(4) It should have a pectic enzyme level sufficiently low so that the product will not separate (clarify) or cause gelation after a prolonged storage period at 40° F. Its turbidity, after reconstitution and centrifuging, should be very nearly equal to the turbidity of freshly extracted juice after centrifuging.

(5) It should have retained 95 to 100% of the ascorbic acid originally present in the juice.

In addition to the above, the finished product must meet certain subjective standards. First of all, it should have a very definite fresh fruit character. With orange juice, for example, it must be of good fresh orange flavor and be pleasing to the taste. It must have good color. That is, it must look like orange juice. It must be free of off-odors and off-flavors, free of dirt and foreign matter, pieces of peel, albedo and large seeds, or otherwise defective particles.

A quality control program where the buyer shares responsibility with the packer can make the job of quality control one which operates to the satisfaction of both parties.

The Effect of Cathode Rays on Bacteria

ROBERT B. EDWARDS,[a] LAURA J. PETERSON, AND DONALD G. CUMMINGS[b]
The Research Laboratories, The Upjohn Company, Kalamazoo, Michigan

(Manuscript received February 10, 1953)

Experiments to determine whether or not the action of cathode rays in the destruction of bacteria follows the general laws of electro-magnetic irradiation are described. The effects of irradiation under varied temperature, pH, salt concentration, the presence of protein, and numbers of microorganisms are also reported.

The lethal effect on bacteria of the electromagnetic spectrum rays has been the subject of scientific investigations for over 50 years. Although the bactericidal action of ultraviolet light has been extensively investigated by Ward *(21)* in 1894, and to a lesser extent the alpha, beta and gamma rays by Prescott *(15)* in 1904; Chambers and Russ *(3)* in 1912; Spencer *(19)* in 1934; Dozois *(6)* in 1936; Lea *et al., (14)* in 1937; and Spear *(18)* in 1944, studies with cathode rays have been meager, principally because of their unavailability in a form suitable for biologic investigation.

Cathode rays, or artificially accelerated electrons, were first projected outside the cathode ray tube by Coolidge *(5)* in 1925. This enabled investigators for the first time to study their effect on biologic materials. Wyckoff *(23)* in 1930, in a quantitative study, exposed *Escherichia coli* and *Salmonella aertrycke* to a definite number of electrons from a cathode ray tube. He reported marked lethal activity of cathode rays but noted that significant quantitative data might be obtained only if the cells occurred singly at the time of irradiation. In general, when bacteria are exposed to rays of the electromagnetic spectrum, the curves obtained are exponential in character when the percentage of organisms surviving is plotted as a function of dose. Occasionally, however, survival curves which deviate from the logarithmic type are noted. It is probable that this is due to such factors as clumping, reported by Gates *(9)* in 1929, or the age of the cell, which alters its sensitivity to irradiation, as demonstrated by Bachem and Dushkin *(1)* in 1933, or to the fact that multiple hits may be required for destruction of a single cell instead of just one hit.

Various physical and chemical agents affect the lethal action of radiations to varying degrees. Within certain limits, the lethal action of x-rays, radioactive emanations and ultraviolet light are not affected by temperature *(2, 9, 14)*. Bayne-Jones *(2)* reported that a pH below the isoelectric point greatly enhanced the action of ultraviolet light. The presence of heavy inorganic salts in high concentrations increased the effect of x-rays *(4)*. A non-absorbing medium must be used when irradiating with ultraviolet light if results are to be significant *(10, 11)*. The authors are unaware of reports concerning the effects of these agents on the lethal activity of cathode rays.

Recently, a 2,000,000 volt, vertically mounted, Van de Graaff electron accelerator, was purchased by The Upjohn Company for research purposes. Since it was obvious that the Van de Graaff machine offered a method for the sterilization of pharmaceutical preparations not amenable to other procedures, it was desirable for both practical and economic reasons to establish the dosage of cathode rays necessary to render inviable certain bacterial populations. In other words, if cathode rays were to be used for sterilization, it would be beneficial to know whether the killing of bacterial cells, by this method, follows the same general laws that have been established for other electromagnetic irradiations. In addition, we wished to determine what effect the introduction of certain chemical and physical factors during irradiation would have on the bactericidal activity of the cathode rays. Irradiation in the presence of such factors as variation in the number of microorganisms, temperature, pH, salt concentration and the presence of protein was considered.

METHODS AND MATERIALS

Dosage determinations. All samples were irradiated with a mono-energetic beam of two million volt electrons from a vertically mounted Van de Graaff accelerator capable of delivering up to 100 micro-amperes of electron beam current at this energy level. The generator voltage and current as read on the instrument panel were used as a measure of the total energy. The power actually absorbed by the test samples was determined from a correlation between total energy and that fraction absorbed in depth and cross section of the sample, e.g., the power absorbed by these samples was a function of total beam current as read on a meter and time of irradiation. The time element was controlled by the speed of a belt which carried these samples through the cone of irradiation *(20)*.

A concerted effort was made to minimize the nonuniformity of energy within the sample. The depth of the sample of 0.5 g. per cm. was chosen because at this depth the efficiency of 2×10^6 volt electrons is highest, i.e., at this level the average power absorbed per g. of material is the highest, assuming no absorber of significant thickness above the sample *(8)*. The distribution across the belt was made nearly uniform by irradiating through 61 cm. of air. The distribution of ionization along the belt was integrated by the motion of the sample. Calibration indicated that the minimum ionization within the target sample was 61.5% of the average. The minimum dose is that which has been recorded throughout this paper because, it is felt, that this, not the average nor the maximum, is most important in ascertaining the lethal effects of the irradiation. Absorbed power (dosage) has been expressed in Roentgens Equivalent Physical (rep) using the conversion factor of 8.3 joules per g. of tissue equal to 10^6 rep *(8)*.

Method of preparing cells. *Bacillus subtilis* (No. 6633ATC) spores were selected as the test organism to be used throughout the study because of their stability and relative resistance to ordinary types of sterilization. The spore suspensions were prepared according to the following method:

A suspension of *B. subtilis* spores was inoculated in Roux bottles containing approximately 100 ml. of solidified Bacto-Mycin assay agar (Difco). The cultures were incubated at 37° C. for 7 days and the growth washed off with sterile double distilled water. The cells were heated at 65° C. in a water bath for 30 minutes and washed three times by centrifugation before

[a] Present address: Lambert Pharmacal Co., St. Louis 6, Missouri.

[b] Present address: Bell Aircraft Co., Heilman Field, Alamagordo, New Mexico.

resuspension in sterile double distilled water. Sedimentation was at 2,000 RPM for 30 minutes. After the final washing, the suspension was reheated for 30 minutes at 65° C. Following the final heating, the number of viable spores was determined utilizing the dilution agar plate technique. The stock suspension was then diluted to contain approximately 1 x 10^8 org/ml. and stored in the refrigerator until used. No appreciable drop in viable spore count was noted during a 3-month period.

When instituting an experiment, the stock suspension was diluted to contain the required number of organisms. To prepare a 1 x 10^7 org/ml. suspension, the stock was diluted 1:10 with the suspending medium under investigation. For a 1 x 10^4 org/ml. suspension, the stock was diluted 1:1000 in sterile distilled water and a final 1:10 dilution prepared using the suspending medium under investigation.

In order that the effect of irregular depth might be minimized, flat bottom petri plates (Corning No. 3162) were selected for use as irradiation vessels. Aseptic conditions were maintained during irradiation by covering with 0.001-inch thick Reynold's aluminum foil. In all our investigations, a fluid medium was utilized for suspending the organisms during irradiation, so that the cells could be removed from the presence of the physical and chemical agents immediately following irradiation. In this way, the direct effect of the agents on the cells might be minimized. The sample depth, which when irradiated, would result in maximum ionization was 5.0 mm. With our irradiation vessels this required a volume of 27 ml. This volume was used throughout the study.

RESULTS

Since our primary purpose was to determine whether there might be a direct relationship between dosage and the percentage of spores surviving, conditions which would put as little stress on the organisms as possible were selected. Accordingly, the spores were suspended in 0.85% NaCl solution, buffered at pH 7.2 and irradiated at a room temperature of 27° C. These were designated as "normal conditions" and were used as such throughout the study.

The determination of the relationship between the dosage and the percentage survival under "normal conditions." This was accomplished by irradiating suspensions with various dosages ranging from 3,000 to 1,290,000 rep. Two populations of freshly prepared cells containing 1 x 10^4 and 1 x 10^7 spores per ml. in buffered saline were used. Twenty-seven ml. of the spore suspension were immediately pipetted into the sterile, foil-covered vessels and placed on a moving belt which passes through the electron beam. Aliquots of the suspensions were also retained as non-irradiated control samples.

Immediately following irradiation, the number of *B. subtilis* spores surviving was determined. Appropriate dilutions of the samples were prepared in buffered saline and 10 one-ml. samples were plated at each dilution in meat infusion agar. The non-irradiated control samples were handled in exactly the same manner as the irradiated samples. Dilution and plating of the control samples followed immediately the plating of the irradiated samples. The entire procedure was completed within 15 minutes. All plates were incubated at 37° C. for 24 hours. Plates containing 30 to 300 colonies were counted and the average number of colonies per plate determined. The percentage of organisms surviving cathode irradiation was calculated from the mean counts of the exposed and non-exposed samples (Table 1, Figure 1).

Statistical analysis of the data disclosed the survival curves to be logarithmic within certain limits. Tests of linearity of the data plotted on semi-log paper show an almost straight line relationship existing between limits of 3,000 to 120,000 rep (Figure 2). However, if limits of 3,000 to 96,000 rep are considered, the data are strictly linear. For the 1 x 10^4 spore/ml. population, the curve has a formula of log y = 1.00761 — 84.871 x 10^{-6}X between 3,000 and 96,000 rep. Similarly, the same figure shows the curve when the data from the 1 x 10^7 spore/ml. population were plotted. The formula for this curve is log y = 1.99426 — 80.535 x 10^{-6}X and tests of linearity show the data to be linear between 6,000 and 120,000 rep. Although the formulae of these 2 curves are not identical, the difference is within the experimental error and the data could, therefore, be expressed as one curve.

TABLE 1
The effect of increasing rep on the percentage survival of Bacillus subtilis spores

10,000 Organisms/ml.			10,000,000 Organisms/ml.		
Dose in rep	No. plates counted	Average percent survival	Dose in rep	No. plates counted	Average percent survival
3,000	60	95.0	6,000	60	91.95
6,000	60	86.3	12,000	60	81.74
13,200	60	77.4	30,000	20	62.4
25,800	60	58.4	34,800	120	50.34
34,800	400	50.8	39,000	40	46.65
36,000	60	44.0	120,000	80	10.81
54,000	60	35.2	660,000	20	0.0005
72,000	20	24.1	732,000	20	0.000168
75,000	40	21.0	786,000	20	0.000041
99,000	20	17.2	972,000	20	0.000001
120,000	360	8.5	1,026,000	20	0.0000049
150,000	20	4.8	1,098,000	20	0.0000011
162,000	20	4.12	1,140,000	20	0.0000002
204,000	20	1.5	1,290,000	60	0.0
300,000	20	0.247			
366,000	20	0.061			
456,000	20	0.016			
600,000	20	0.00036			
660,000	280	0.0			

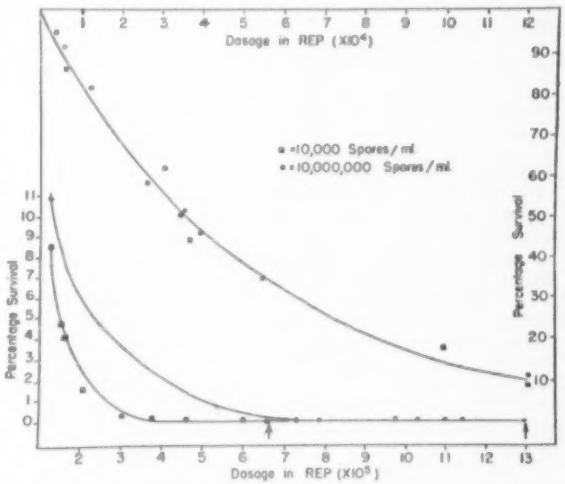


Figure 1. Percentage of B. subtilis spores surviving doses of 3,000 to 1,290,000 rep.

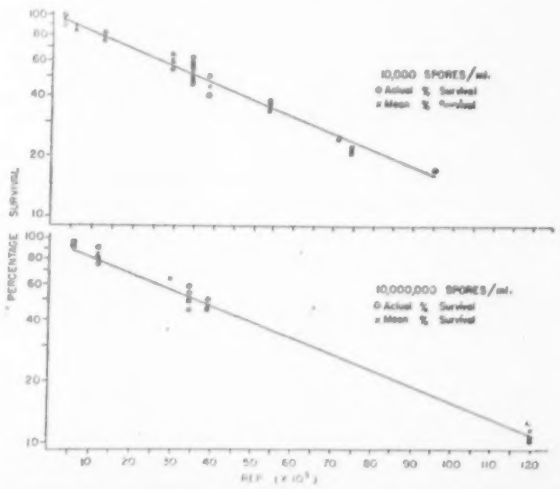


Figure 2. Relationship between dosage in rep and the percentage of spores surviving exposure to cathode rays.

TABLE 2

Standard values for the percentage of Bacillus subtilis spores surviving irradiation under "normal conditions"

Spores/ml.	Dose in rep	Number plates	Non-Irradiated control		Irradiated suspension		Percentage survival S. E.*	
			Mean count/ml.	S. E.*	Mean count/ml.	S. E.*		
10,000/ml.	34,800	200	9,849	350	4,999	180	50.76	2.55
10,000/ml.	120,000	180	9,871	400	837	38	8.48	0.52
10,000/ml.	660,000	140	9,982	389	0		0	
10,000,000/ml.	34,800	60	10,648,333	543,184	5,270,000	333,827	50.34	4.13
10,000,000/ml.	120,000	40	10,312,500	539,828	1,114,500	53,218	10.80	0.77
10,000,000/ml.	1,290,000	30	10,120,000	509,612	0		0	

* Standard Error—Two standard deviations.

Since it is apparent that, at least within certain limits, a direct relationship exists between the percentage of spores surviving and the dosage in rep, it would therefore be possible to determine from the curves a dosage which would result in a certain percentage of spores surviving, no matter what the initial population might be. To test this assumption, dosages which would result in 50, 10 and 0 percentage survival were selected. The purpose in doing this was two-fold. Firstly, it was desired to test the curve experimentally. Secondly, it was necessary to establish the most probable values for percentage survival under "normal conditions" at three levels, to obtain data that could be used as a basis for comparison when certain variables were introduced during irradiation.

From Figure 1, the values of 34,800; 120,000 and 660,000 rep are noted to result in 50, 10 and 0 percentage survival respectively, when 1 x 10^4 org/ml. are irradiated. Likewise, 34,800; 120,000 and 1,290,000 rep result in 50, 10 and 0 percentage survival respectively, when 1 x 10^7 org/ml. are irradiated. These were the dosages in rep selected for further study.

To establish the most probable values for percentage survival when irradiating under "normal conditions," a number of experiments were conducted in which both populations of organisms were exposed to the 3 dosages selected above. In all cases, the values for the percentage surviving were determined in the manner previously described.

The data were then analyzed statistically and the mean percentage survival calculated. These values were termed "standard values" and were used as a basis for comparison (Table 2). The standard error used throughout our data is essentially two standard deviations. In all cases where comparisons are to be made, the standard error has been adjusted to a common sample size. This is illustrated where the percentage survival at the 3 dosage levels of the 2 populations of organisms is presented (Table 3). In this table the standard error is adjusted to a common sample size and the effect of the rays on 2 spore populations may be validly compared.

The effect of temperature. Temperatures chosen for study were 44° C., 0° C. and —65° C. Both concentrations of spores (1 x 10^4 and 1 x 10^7 org/ml.) were irradiated at all 3 temperatures. The suspending medium was 0.85% NaCl buffered at pH 7.2. Suspensions irradiated at 0° C. were prepared at this temperature just prior to exposure. During irradiation the samples were placed in a melting ice bath. The samples irradiated at 44° C. were also prepared just prior to exposure and placed in a thermostatically controlled oven at 45° C. Aliquots of the suspensions were pipetted into the irradiation vessels which previously had been brought to 45° C. At the time of irradiation the vessels containing these suspensions were removed from the oven and placed on a heated quarter-inch-thick soap stone. Measurements of the control samples showed an average drop of 1° C. during the time necessary for exposure in the machine. Thus, samples were considered irradiated at approximately 44° C. Frozen samples were prepared 2 to 3 hours before irradiation. The suspensions were pipetted into irradiation vessels which were then placed in a deep freeze at —60° C. No attempt was made to maintain a temperature of —60° C. during irradiation. The samples irradiated at 34,800 and 120,000 rep showed practically no increase in temperature. However, those exposed to 660,000 and 1,290,000 rep had warmed to about —35° C. This rise in temperature was accounted for in the increased length of time of exposure which was necessary at the higher dosages.

In all cases, non-irradiated control samples were prepared and maintained at the same temperatures as those of the irradiated samples. In the preparations irradiated at 0° C. and 44° C., the number of organisms in the irradiated and non-irradiated suspensions was determined immediately following exposure. Frozen samples were allowed to thaw at room temperature before sampling. This took about 30 minutes. No difference in thawing time was noted between the irradiated and non-irradiated samples. From the plate counts of these samples, the percentage survival was calculated (Table 4).

TABLE 3

Effect of concentration of organisms on percentage survival of Bacillus subtilis spores

Dose in rep	Organisms/ml.	Percentage survival	Standard Error (corrected)*
34,800	10,000	50.76	5.06
34,800	10,000,000	50.34	4.13
120,000	10,000	8.48	1.27
120,000	10,000,000	10.81	0.77
660,000	10,000	0	
660,000	10,000,000	0.000522	0.00008
1,290,000	10,000,000	0	

* Standard Error corrected on the basis of a common sample size for comparison purposes.

TABLE 4

Effect of temperature on percentage survival of Bacillus subtilis spores

Temp.	10,000 Org/ml.					10,000,000 Org/ml.				
	Dose in rep	% Survival	S. E.*	Standard value		Dose in rep	% Survival	S. E.*	Standard value	
				% Survival	S. E. (corrected)**				% Survival	S. E. (corrected)**
0° C.	34,800	54.72	7.65	50.76	5.9	34,800	54.00	9.37	50.34	7.47
Frozen	34,800	54.64	7.03		5.9	34,800	47.42	5.6		7.47
44° C.	34,800	50.64	5.35		8.63	34,800	55.67	11.72		7.47
0° C.	120,000	5.46	0.86	8.48	1.65	120,000	8.51	1.27	10.81	1.12
Frozen	120,000	3.91	0.5		1.13	120,000	7.68	0.74		1.12
44° C.	120,000	15.7	2.9		1.65	120,000	13.2	1.02		1.12
0° C.	660,000	0		0		1,290,000	0		0	
Frozen	660,000	0		0		1,290,000	0		0	
44° C.	660,000	0		0		1,290,000	0		0	

* Standard Error—Two standard deviations.

** Standard Error corrected on the basis of a common sample size for comparison purposes.

It may be seen that at a dosage of 34,800 rep, no effect of temperature on percentage survival is noted with either spore population. However, at a dosage of 120,000 rep, the percentage of spores surviving in a 1×10^4 org/ml. population is altered by all 3 temperatures. When 1×10^7 org/ml. are irradiated at this dosage, only those samples irradiated while frozen or at 44° C. showed any difference from those irradiated under the so-called "normal conditions." It is of interest to note that in each case the suspensions irradiated while frozen show a decrease in the percentage survival while those irradiated at 44° C. show an increase. No effect of temperature is noted at the 0 percentage survival level with either population of spores.

The effect of pH. The pH levels investigated were 5.4 and 9.0. Samples irradiated at pH 5.4 were prepared in 1/15 molar phosphate buffer which contained 0.85% NaCl. Samples irradiated at pH 9.0 were prepared in a 0.1M glycine-NaOH buffer mixture to which 0.85% NaCl was added. Samples were irradiated at 27° C. The non-irradiated control samples were maintained under the same conditions as the irradiated samples. Plate counts and the percentage of spores surviving irradiation were determined (Table 5). It may be seen that at a dosage of 34,800 rep, the percentage of spores surviving did not differ from the values obtained under "normal conditions." When a concentration of 1×10^7 spores/ml. was irradiated with 120,000 rep at pH 9.0, a very slight increased percentage survival was obtained. This was not evident with a concentration of 1×10^4 spores/ml. or at the zero percentage survival level with either spore population.

The effect of salt concentration. The salt concentrations investigated were 0.25% and 2.0% NaCl dissolved in 1/15 molar phosphate buffer at pH 7.2. Suspensions of *B. subtilis* spores were prepared to contain 1×10^4 and 1×10^7 org/ml. in these mixtures. Irradiation was at 27° C. Non-irradiated control samples were maintained under the same conditions as the irradiated samples. Plate counts and the percentage of spores surviving were determined in the usual manner (Table 6).

It is noted that at 34,800 rep no effect of salt concentration was evident. Only at a dosage of 120,000 rep on 1×10^4 spores/ml. suspended in 2.0% NaCl was there a slight difference from the normal control. This was not shown with a spore population of 1×10^7 spores/ml. nor at the 0 percentage survival levels.

The effect of protein. The investigation of the effect of protein on the bactericidal activity of cathode rays is incomplete. However, a few experiments have been completed and are reported herein.

As a source of protein, skim milk was added to the buffered saline suspended spores to a final concentration of 5%. Micro-Kjeldahl determinations on a 5% solution of skim milk showed 0.23 mg./ml. of nitrogen. To this total nitrogen value, 1×10^7 spores/ml. contribute 0.018 mg./ml. more. Nitrogen determinations were not done on the 1×10^4 spore suspension.

The suspensions containing 5% milk were irradiated with dosages which would produce 50, 10 and 0 percentage survival under "normal conditions." Plate counts showed no difference from the normal controls at the 50% survival level with either the 1×10^4 or 1×10^7 spore populations (Table 7). Increase in the number of spores surviving was noted at the 10% survival

TABLE 5

Effect of pH on percentage survival of Bacillus subtilis spores

pH	10,000 Org/ml.					10,000,000 Org/ml.				
	Dose in rep	% Survival	S. E.*	Standard value		Dose in rep	% Survival	S. E.*	Standard value	
				% Survival	S. E. (corrected)**				% Survival	S. E. (corrected)**
5.4	34,800	55.15	6.97	50.76	8.63	34,800	53.18	5.9	50.34	7.47
9.0	34,800	47.89	14.50		8.63	34,800	48.88	4.58		7.47
5.4	120,000	6.06	1.16	8.48	1.65	120,000	9.2	1.17	10.81	1.12
9.0	120,000	9.41	1.99		1.65	120,000	13.51	1.48		1.12
5.4	660,000	0		0		1,290,000	0		0	
9.0	660,000	0		0		1,290,000	0		0	

* Standard Error—Two standard deviations.
** Standard Error corrected on the basis of a common sample size for comparison purposes.

TABLE 6

Effect of NaCl concentration on percentage survival of Bacillus subtilis spores

NaCl Conc.	10,000 Org/ml.					10,000,000 Org/ml.				
	Dose in rep	% Survival	S. E.*	Standard value		Dose in rep	% Survival	S. E.*	Standard value	
				% Survival	S. E. (corrected)**				% Survival	S. E. (corrected)**
0.25%	34,800	51.55	3.69	50.76	8.63	34,800	58.93	7.81	50.34	7.47
2.0%	34,800	53.92	3.87		6.89	34,800	49.20	5.56		7.47
0.25%	120,000	9.55	0.78	8.48	1.31	120,000	11.10	1.06	10.81	0.89
2.0%	120,000	6.18	0.61		1.65	120,000	10.58	1.12		0.89
0.25%	660,000	0		0		1,290,000	0		0	
2.0%	660,000	0		0		1,290,000	0		0	

* Standard Error—Two standard deviations.
** Standard Error corrected on the basis of a common sample size for comparison purposes.

TABLE 7

Effect of 5% skim milk on percentage survival of Bacillus subtilis spores

10,000 Org/ml.					10,000,000 Org/ml.				
Dose in rep	% Survival	S. E.*	Standard value		Dose in rep	% Survival	S. E.*	Standard value	
			% Survival	S. E. (corrected)**				% Survival	S. E. (corrected)**
34,800	57.66	4.7	50.76	8.63	34,800	56.96	10.17	50.34	7.47
120,000	13.45	1.95	8.48	1.65	120,000	12.87	1.47	10.81	1.12
660,000	0		0		1,290,000	0		0	

* Standard Error—Two standard deviations.
** Standard Error corrected on the basis of a common sample size for comparison purposes.

level with a 1×10^4 spore suspension but not with a 1×10^7 population. No difference from the values obtained under "normal conditions" was found at dosages producing complete kill.

Several exploratory experiments in which gelatin was introduced during exposure to the rays indicated that as the concentration of gelatin is increased, the percentage of spores surviving also increased.

Miscellaneous Experiments

The effect of time and intensity. In order to obtain the higher dosages (i.e., 660,000 to 1,290,000 rep) with our machine, it was necessary to lengthen the exposure time. This was accomplished by slowing the speed of the belt on which the sample was placed. The 34,800 and 120,000 rep were both delivered using a belt speed of 8.3 feet per minutes. The 660,000 and 1,290,000 rep dosages were obtained with a belt speed of one foot per minute. Bachem and Dushkin *(1)* working with *Serratia marcescens* reported that if the product of the intensity and exposure time were kept constant, the effect of ultraviolet irradiation remained the same. This is an expression of the Bunsen-Roscoe Law. No reports were found concerning the effect of varying time and intensity of cathode ray irradiation. To determine whether any error might be introduced by varying exposure time, a dose of 34,800 rep was administered in 3 ways (Table 8).

TABLE 8

Determination of effect of varying exposure time and intensity of cathode ray irradiation on percentage survival of Bacillus subtilis spores

Dose in rep	Belt speed	Amperage	Organisms/ml.	% Survival	St. Error*
34,800	8.3 ft./min.	25 γA	10,000,000	54.4	4.7
34,800	8.3 ft./min.	25 γA	10,000	51.6	8.8
34,800	3.03 ft./min.	9 γA	10,000,000	44.2	4.2
34,800	3.03 ft./min.	9 γA	10,000	56.3	5.5
34,800	1.0 ft./min.	3 γA	10,000,000	52.7	5.1
34,800	1.0 ft./min.	3 γA	10,000	61.5	6.9

* Standard Error—Two standard deviations.

Spore suspensions containing 1×10^4 and 1×10^7 spores/ml. were prepared using the buffered saline. These were then irradiated at the 3 belt speeds and amperages indicated in the table. Following irradiation the percentage of spores surviving was determined in the usual manner. It will be seen that the percentage survival does not vary in any significant manner in any of the exposure periods. Therefore, it would seem that the variation of time and intensity under the conditions of our experiments does not measurably affect our data.

Photo reactivation. It has been shown that irradiation injured cells, under certain conditions, may be reactivated by exposure to visible light *(13, 7, 12)*. Since no attempt was made to shield our plates from light, it was felt that some error might have been incurred. To determine whether photoreactivation was a factor under the conditions of our experiments, 1×10^4 spores/ml. suspended in the buffered saline were irradiated with 34,800; 120,000 and 660,000 rep. Twenty plates were prepared from each of the irradiated samples and controls. After plating, 10 plates from each sample and control were illuminated with two General Electric No. 2 reflector flood lamps for one hour. These lamps were suspended approximately three feet from the surface of the plates. Temperatures of the samples, taken periodically, showed only a slight increase. After exposure to the flood lamps, the plates were incubated for 24 hours at 37° C. The percentage survival of spores subjected to photo-flood treatment following irradiation was compared to that obtained from the non-illuminated plates. No significant difference in count was observed between the illuminated and non-illuminated plates.

Stunning versus killing. Since it might be possible for spores to receive a sublethal dose of electrons, it was important to determine whether this was true under the conditions of our experiments. If it could be shown that a significant number of cells might be stunned rather than killed, then much of our data would be invalid.

To test this assumption, a series of plates prepared from both irradiated suspensions and controls were held at room temperature for 5 days following their initial incubation of 24 hours at 37° C. The mean counts of the 5-day reincubated plates showed no appreciable increase over the initial counts.

To further investigate the possibility that spores might be injured rather than killed, experiments were instituted to determine whether there was any difference in the rate of cell division between the treated and untreated spore preparations. This was accomplished by suspending the irradiated spores in broth and withdrawing aliquots every 15 minutes. These were then plated and counted in the usual manner. Counts obtained did not differ significantly from those obtained with similarly treated unirradiated controls. It would seem, therefore, that these two experiments fail to show any evidence that spores had received a sublethal dose of electrons.

The production of bactericidal substances in the medium by cathode rays. Experiments were instituted to determine whether the lethal action of electrons on *B. subtilis* spores might result from the production of bactericidal substances in the medium as a consequence of bombardment. This was accomplished by subjecting samples of the buffered saline to 34,800; 120,000 and 660,000 rep. *B. subtilis* spores were than added immediately following irradiation to a concentration of 1×10^4 cells/ml. Following a period of time equal to that required for irradiation, aliquots were removed and the number of surviving spores were determined. No reduction in count due to exposure of spores to the irradiated medium could be detected. It would therefore appear that no bactericidal substances had been produced under the conditions of these experiments.

The relationship between population of spores and the dosage producing complete kill. It was previously noted that as the number of organisms per ml. increased, a greater dosage was required to bring about complete kill (Table 1, Figure 1). Since there was a thousand-fold difference in count between the two populations, we wished to determine whether this effect could be shown for other spore populations as well. Accordingly, concentrations of spores varying by a factor of 10, from 1 through 1×10^6 org/ml., were prepared in the buffered saline. These were then irradiated and the dosage producing complete kill determined from the plate counts. The dosages in rep which would sterilize these suspensions are plotted against the number of spores per ml. (Figure 3). Plotted also are the dosages in rep at which sterility was not quite achieved. The zone between

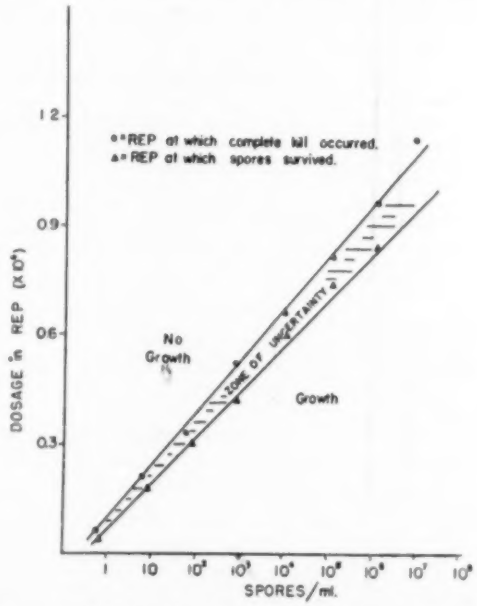


Figure 3. Relationship between population and dosage required for sterilization.

these 2 curves is termed the "zone of uncertainty." It is obvious that the methods used would not show the exact dosage at which sterility was achieved. However, it would appear that a logarithmic relationship exists between the number of organisms present and the dosage required for complete kill. This is in line with work published previously by Proctor and Goldblith *(16, 17)*.

DISCUSSION

Between dosages of 3,000 to 96,000 rep, the percentage survival of a 1×10^4 spore/ml. population appears to be logarithmic (Figure 2). A similar response is seen between 6,000 and 120,000 rep when 1×10^7 spores/ml. are irradiated. Although the slopes of the two curves are not identical, the difference is so small that it is within the experimental error and could, therefore, be expressed as a single curve. That the response of the cells to the rays does not appear to be linear in some areas of the survival curves might be explained by the inability of the methods used to measure all spore populations with the same degree of accuracy. Furthermore, the efficiency of our irradiation methods is undoubtedly not the same at different population levels.

The paradoxical results obtained in our temperature experiments were unexpected. The increased kill at frozen temperatures as well as the apparent protection at elevated temperatures would certainly seem to indicate that the mechanism which brings about the demise of the cells is not the same as sterilization by chemical agents. We have repeated these experiments many times—always with the same results. Clearly more work is indicated before the explanation of this phenomenon can be made.

No profound effect on the lethal activity of the rays was apparent when irradiations were performed at the several pH levels nor at the different salt concentrations.

The preliminary experiments of irradiating in the presence of protein are of practical interest. Since the incorporation of even a small percentage of protein into the system seems to provide some protection from the activity of the radiations, the increased dosage needed to sterilize such preparations may be great enough, in certain instances, to destroy the active principles contained therein.

The experiments in which the time and the intensity of the dosages were varied are highly significant. Had the percentage survival varied in any appreciable manner, much of the data would have been invalidated since it was necessary to vary both time and intensity to deliver the dosages utilized.

The attempts to demonstrate photoreactivation are probably open to criticism since time did not permit exhaustive experiments. This is likewise true of the experiments designed to show sublethal doses of electrons as well as any production of bactericidal substances resulting from the irradiation of the suspending medium. However, with the methods used, neither photoreactivation nor non-fatal injury of cells was demonstrated. Bactericidal substances were not demonstrable in the irradiated suspending medium.

The experiments designed to show the relationship between population of spores and the dosage producing complete kill, demonstrate again that exacting methods are necessary before the precise dose which will sterilize any given cell population can be determined. The data reported, however, are of practical significance in that the dosage needed to sterilize certain pharmaceutical preparations may be readily predicted so long as the bacterial population is known. Although the data seem to indicate that almost any cell population may be sterilized by cathode rays, it must be borne in mind that certain pharmaceutical preparations are also decomposed by cathode irradiation. It is therefore desirable in the manufacture of such products to exercise the care and cleanliness necessary to prevent them from becoming grossly contaminated in order that small dosages of rep can be used to effect their sterilization.

SUMMARY

Within certain dosage limits, the percentage of *B. subtilis* spores surviving cathode ray irradiation appears to be exponential. That the response of the cells is not logarithmic at some dosages, may be due to the inability of the methods used to measure all spore populations with the same precision. Furthermore, the efficiency of the irradiation methods may not be the same at the different population levels.

The temperature of the suspending medium had a marked influence on the percentage of spores surviving irradiation. Exposure of the cells at elevated temperatures resulted in a decreased kill while low temperature produced increased destruction.

No profound effect in the lethal activity of the rays was apparent when irradiations were performed at several pH levels, nor at different salt concentrations. The presence of a small amount of protein provides some protection to the spores.

Keeping the dosage constant but varying the time and the intensity did not result in any significant difference in the percentage of spores surviving. Photoreactivation was not demonstrated. Neither sublethal dosages nor the production of bactericidal substances in the irradiated suspending medium could be shown.

A logarithmic relationship appears to exist between the number of organisms present and the dosage required for complete kill.

Acknowledgment

It is a pleasure to acknowledge our indebtedness to Dr. Burton D. Seeley for the statistical analysis and to Mrs. Elaine Nelson for technical assistance.

LITERATURE CITED

1. Bachem, A., and Dushkin, M. A. Time factors concerned in the germicidal action of ultraviolet light. *Proc. Soc. Exp. Biol.*, **30**, 700-704 (1933).
2. Bayné-Jones, S., and Van der Lingen, J. S. Bactericidal action of ultraviolet light. Johns Hopkins Hospital *Bulletin*, **34**, 11-16 (1923).
3. Chambers, H., and Russ, S. The bactericidal action of radium emanations. *Proc. Roy. Soc. Med.* (London), **5**, 198-212 (1912).
4. Claus, W. D. Enhanced lethal effects of x-rays on *B. coli* in the presence of inorganic salts. *J. Exp. Med.*, **57**, 335-347 (1933).
5. Coolidge, W. D. High voltage cathode rays outside the generating tube. *Science*, **62**, 441-442 (1925).

6. Dozois, K. P., Ward, G. E., and Hachtel, F. W. Effect of gamma rays on *Bacterium coli*. *Am. J. Roentg.*, **35**, 392-397 (1936).
7. Dulbecco, R. Experiments on photo-reactivation of bacteriophage inactivated with ultraviolet radiation. *J. Bact.*, **59**, 329-47 (1950).
8. Evans, R. D. Radioactivity units and standards. *Nucleonics*, **1**, 32-43 (October, 1947).
9. Gates, F. L. A study of the bactericidal action of ultraviolet light I and II. *J. Gen. Physiol.*, **13**, 231-248 and 249-260 (1929).
10. Gates, F. L. A study of the bactericidal action of ultraviolet light III. *J. Gen. Physiol.*, **14**, 31-42 (1930).
11. Hollaender, Alexander, and Claus, W. D. Bactericidal action of ultraviolet light. *J. Gen. Physiol.*, **19**, 753-765 (1936).
12. Johnson, E. H., and Flagler, E. A. Relation of oxygen to photoreactivation of bacteria after ultraviolet irradiation. *Proc. Soc. Exp. Med.*, **74**, 32-35 (1950).
13. Kelner, A. Photo-reactivation of ultraviolet irradiated *E. coli* with special reference to the dose reduction principle and to ultraviolet induced mutation. *J. Bact.*, **58**, 511-522 (1949).
14. Lea, D. E., Haines, R. B., and Coulson, C. A. The action of radiations on bacteria III. *Roy. Soc. Proc. B*, **123**, 1-21 (1937).
15. Prescott, S. C. Effect of radium rays on the colon bacillus, the diphtheria bacillus and yeast. *Science*, **20**, 246-248 (1904).
16. Proctor, B. E., and Goldblith, S. A. A critical evaluation of the literature pertaining to the application of ionizing radiations to the food and pharmaceutical field. *Tech. Rept. No. 1*, January, NYO 3337 (1952).
17. Proctor, B. E., and Goldblith, S. A. Chapter 34 in Reddish, G. F. *Antiseptics, Disinfectants, Fungicides and Sterilization*. 1954, Lea & Febiger, Philadelphia.
18. Spear, F. G. The action of neutrons on bacteria. *Brit. J. of Radiol.*, **17**, 348-351 (1944).
19. Spencer, R. R. The sensitivity *in vitro* of bacteria to the beta and gamma rays of radium. *Public Health Reports*, **49**, 183-192 (1934).
20. Trump, J. G., Wright, K. A., and Clarke, A. M. Distribution of ionization in materials irradiated by two and three million-volt cathode rays. *J. Applied Phys.*, **21**, 345-348 (1950).
21. Ward, H. M. Action of light on bacteria. *Roy. Soc. London Phil. Trans.*, **185**, B, 961-986 (1894).
22. Wyckoff, R. W. G. The effects of x-rays, cathode rays and ultraviolet rays on yeast. *Radiology*, **17**, 1171-1175 (1931).
23. Wyckoff, R. W. G., and Rivers, T. M. The effect of cathode rays upon certain bacteria. *J. Exper. Med.*, **51**, 921-932 (1930).

Effect of Display Case Lighting on Color and Bacterial Growth on Packaged Fresh Beef[a,b,c]

A. A. KRAFT and J. C. AYRES
Iowa State College, Ames, Iowa

(Manuscript received November 14, 1953)

Changes in color of packaged beef exposed to ultraviolet radiations are compared with color changes in similar meat stored under Soft White fluorescent light. Effect of ultraviolet radiation on cellophane-wrapped beef is demonstrated to be desiccative. The influence of type and intensity of light on surface bacterial growth on fresh packaged beef is also discussed.

Growth of the self-service method for merchandising meats has stimulated the need for investigations concerning the relation of light to color changes in packaged meats. Several studies have been made which relate to color fading of cured meats exposed to light; less attention has been given to the action of light in causing discoloration of packaged fresh meats.

Germicidal ultraviolet light has been advocated as a means of controlling microbial growth on the surface of meats *(2, 3, 4)* but the use of this type of illuminant has also been criticized because of its harmful effects on color and fat *(7, 8)*. Ramsbottom *et al. (11)* reported that fresh meats became discolored after display for 36 hours under ultra-violet light. These workers and Pracejus *(9)* indicated that fresh meat was very resistant to color change upon exposure to fluorescent light.

Butler *et al. (1)* inoculated beef with *Pseudomonas* spp. and found that the inoculated samples showed greater discoloration than that noted on uninoculated control samples.

It was believed desirable in the present study to compare changes in color of packaged beef exposed to germicidal ultraviolet radiations with color changes in similar meat stored under a commonly used display case illuminant such as Soft White fluorescent light. In addition, consideration was given to the effects of type and intensity of light on surface bacterial growth on fresh packaged beef.

EXPERIMENTAL PROCEDURE

Round steak was purchased from a local grocery store and lean portions cut into pieces of uniform size in the laboratory. Care was taken to prevent contamination from the cutting tools. Samples were allowed to "brighten" by exposing them to air for 20 to 30 minutes in a refrigerator at 4.4° C. and were then packaged. For trials wherein the influence of different lights were compared, the meat was wrapped with 300 gauge MSAT-80 cellophane and with Visten-C (0.001 in.). Packages were heat-sealed and stored in a Percival open-type display case at 2.5° C. ± 1°. During the daily defrosting period, the temperature in the case rose to 10° C., but in no instance did it remain above 3.5° C. for longer than 2 hours.

General Electric 15-watt Soft White fluorescent and germicidal ultraviolet lamps were mounted in the display case at a distance of approximately 30 inches from the trays used to support meat packages. A sheet of black paperboard served as a partition between sections of the display case illuminated by the two types of lamps. In order to reduce the amount of

[a] Journal Paper No. J-2417 of the Iowa Agricultural Experiment Station, Ames, Iowa. Project No. 1161.

[b] This work was supported in part by a grant from Armour and Co., Chicago, Ill.

[c] Data from a thesis submitted by A. A. Kraft in partial fulfillment of the requirements for the degree of Doctor of Philosophy. Present address: Animal and Poultry Husbandry Research Branch, Agricultural Research Service, U.S.D.A., Beltsville, Maryland.

extraneous light entering the case, the glass panels surrounding storage shelves were covered with black paper.

Materials used in testing the effects of light intensity included: 300 gauge MAT-2 cellophane laminated to 200 gauge polyethylene, Pliofilm FF-120, polystyrene Q-641, and 300-gauge MSAT-80 cellophane. In these experiments, packages were stored in the Percival case and in a Victor refrigerator with top open; the latter box operated at a temperature of 1.5° C. ± 1° and was equipped with fluorescent lighting-units.

Light intensity was measured in footcandles by means of a General Electric exposure meter (type DW-68). It was recognized that the glass guard on the light meter may have absorbed a portion of the ultraviolet light and thereby reduced the intensity incident to the photocell. Also, the packaging materials employed differed in their ability to transmit light in the ultraviolet and visible regions of the spectrum.

Color changes in fresh beef were estimated visually and by determinations of spectral reflectance.

A Beckman Model D spectrophotometer with diffuse reflectance attachment *(10)* was employed for reflectance determinations in the region between 540 and 800 mμ; a block of U. S. P. Carbonate of Magnesia served as the standard. Prior to making reflectance readings, the pieces of meat were cut to dimensions of 1½ by 1½ by ¼ inch and covered with a strip of polystyrene Q-641 film in order to prevent meat particles from contacting and adhering to the reflectance attachment housing. Transmission of light by packaging materials was measured by means of the spectrophotometer with hydrogen-discharge and tungsten-filament lamps in the ultraviolet and visible regions of the spectrum respectively.

Changes in weight of packaged samples were determined with a torsion balance having a sensitivity of 2 mg. Surface bacterial counts were made in accordance with procedures described in a previous paper *(6)*.

RESULTS AND DISCUSSION

Measurements were made of the spectral reflectance of 15 slices of freshly cut round steak in order to determine the variation among samples before storage. The color of samples was bright red. Mean reflectance values are indicated by the solid line curve in Figure 1; curves for confidence interval estimates ($P = 0.05$) are shown by broken lines in the same graph. The greatest variation in reflectance of different cuts of beef from the same section of the quarter was found in the region between 650 and 800 mμ, or in approximately the red portion of the spectrum. Visible color changes would also be expected to occur largely in the red region. In later experiments wherein reflectance curves were used as objective measurements of the differences in color of treated samples, account was taken of the variation in reflectance of untreated meat.

Degree of transparency of packaging materials to light of different wavelengths is an important consideration in studying the action of radiant energy on pigments of packaged fresh meats.

Curves for transmission of light by several materials used for wrapping fresh beef are shown in Figures 2 and 3. MSAT-80 cellophane (Figure 2) transmitted considerably more radiation in the ultraviolet and visible regions of the spectrum than did Visten-C; Pliofilm FF-120 was intermediate to these films in transparency. Both Pliofilm FM-1 and Polystyrene Q-641 (Figure 3) allowed passage of a high proportion of light of wavelengths greater than 500 mμ. In addition, the latter film and MSAT-80 cellophane permitted transmission of appreciable amounts of ultraviolet radiation.

In preliminary experiments it was found that little difference existed between changes in color of packaged beef exposed to White fluorescent or Soft White fluorescent light having equal intensities. Discoloration was similar to that of meat wrapped with the same type of materials but held in the dark.

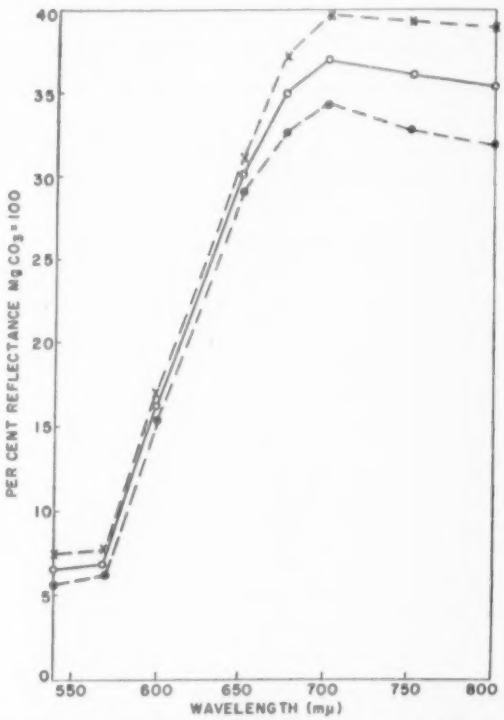


Figure 1. Mean spectral reflectance of fresh red beef.

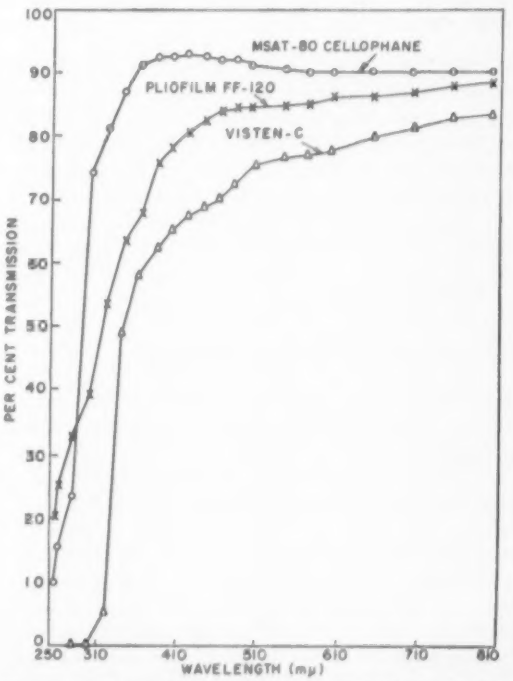


Figure 2. Transmission of light by MSAT-80 cellophane, Pliofilm FF-120, and Visten-C.

Curves for spectral reflectance of beef displayed under germicidal ultraviolet and Soft White fluorescent lights are shown in Figures 4 and 5; the meat was packaged with MSAT-80 cellophane and with Visten-C. The intensity of ultraviolet radiation as measured with the exposure meter was 7 to 10 footcandles at the surface of samples, while the Soft White fluorescent lamp provided

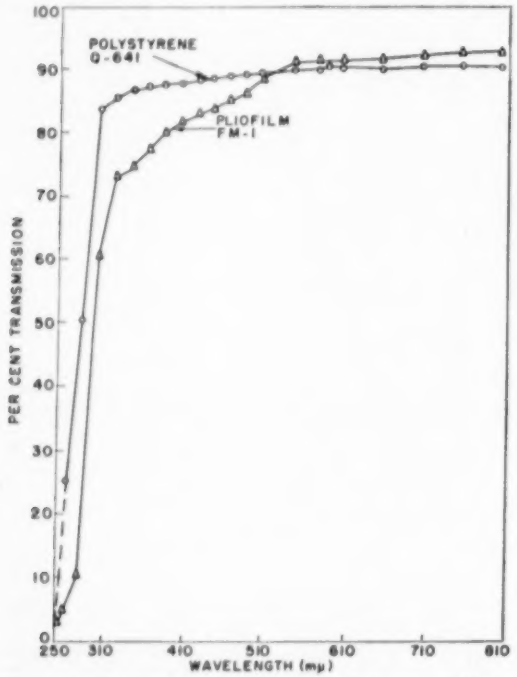


Figure 3. Transmission of light by polystyrene Q-641 and Pliofilm FM-1.

an intensity of 30 to 40 footcandles. Cellophane-wrapped beef (Figure 4) exposed to ultraviolet light exhibited more drastic changes in color and reflectance than those noted when similarly packaged beef was held under Soft White fluorescent light. With display under the ultraviolet lamp, reflectance decreased rapidly during storage for 2 days. The color of samples was dark brown in contrast to the dull red color of meat exposed to fluorescent light. As storage progressed, reflectance values for meat subjected to ultraviolet radiation showed a more gradual decline; darkening of the surface continued until samples appeared brown-black in color. On the other hand, beef stored under fluorescent light demonstrated color changes similar to those previously observed for meat kept in the dark. A slight increase in reflectance occurred at the time when the myoglobin became reduced and the meat was a reddish purple color. Subsequent oxidation to metmyoglobin and increase in desiccation resulted in lower reflectance and brown discoloration. With respect to the time for appearance of dark brown discoloration, shelf life of beef exposed to fluorescent light was extended by 10 days when compared with that for meat irradiated with germicidal ultraviolet light.

Beef wrapped with Visten-C (Figure 5) was not affected by the two types of light in the same manner as

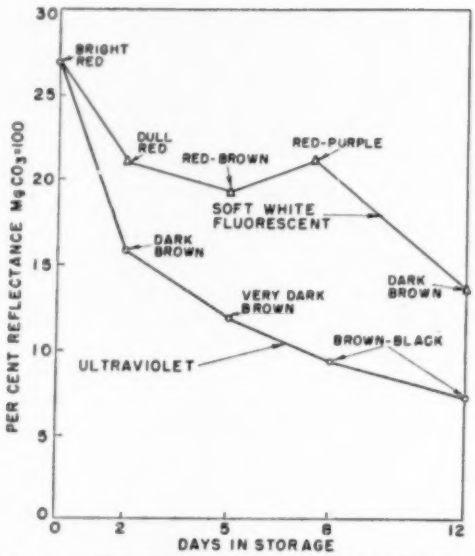


Figure 4. Reflectance and color of beef packaged with MSAT-80 cellophane and exposed to germicidal ultraviolet and Soft White fluorescent light.*

* Each point is the mean of reflectance for two samples measured at 540, 570, 580, 600, 635, 650, 675, 700, and 800 mμ.

was meat packaged with MSAT-80 cellophane. From examination of the two curves in Figure 5 it appears that Soft White fluorescent light produced greater discoloration than did germicidal ultraviolet light. With exposure to either type of illuminant for 2 or 5 days, the meat pigment was converted to a partly oxidized condition. Evidently the oxygen pressure in packages was such that metmyoglobin was formed at a rate similar to that for production of reduced myoglobin. On further display, samples exposed to fluorescent light showed continued oxidation to metmyoglobin. Conversely, the myoglobin of beef held under the ultraviolet light became reduced further as storage time increased. As was the case when MSAT-80 cellophane was used as the wrapper, meat packaged with Visten-C demonstrated an increase in reflectance upon reduction of myoglobin. From these observations it seemed that the intensity of

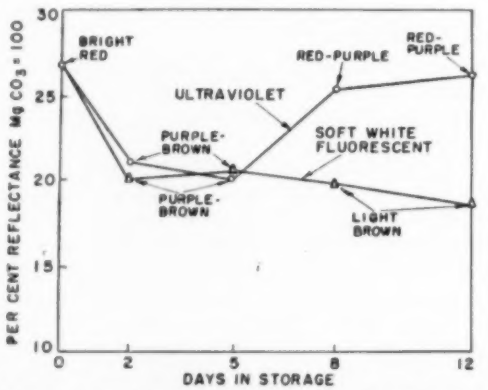


Figure 5. Reflectance and color of beef packaged with Visten-C and exposed to germicidal ultraviolet and Soft White fluorescent light.*

* Each point is the mean of reflectance for two samples measured at 540, 570, 580, 600, 635, 675, 700, 750, and 800 mμ.

ultraviolet radiation on the surface of beef packaged with Visten-C was not sufficiently great to cause as marked discoloration as that which occurred when the meat was wrapped with the more transparent cellophane. This might suggest that some minimum intensity of ultraviolet radiation was necessary for production of discoloration; the cellophane transmitted more ultraviolet light than did Visten-C. These specific experiments were not designed to study the relation of light intensity provided by various illuminants to color changes in packaged meats. Rather, the object of the work here was to compare the general effect of ultraviolet radiation with that of fluorescent light when materials having appreciable differences in transparency were utilized as wrappers. Conditions of display as closely approximated those prevailing in retail stores as was possible; this required that both types of lamps be mounted at the same distance from the samples without consideration being given for the variation in light intensity of the two lamps.

During the course of work with different kinds of illuminants, it was found that meat packaged with MSAT-80 cellophane and exposed to ultraviolet light suffered appreciable dehydration. Weight losses of packaged and unpackaged meat displayed under Soft White fluorescent and germicidal ultraviolet lights are given in Table 1.

TABLE 1
Weight losses of irradiated beef

Packaging material	Type of light	Percent weight loss [1] Days in storage			
		2	5	8	12
MSAT-80 cellophane	Ultraviolet	1.91	6.02	12.9	24.4
	Soft white	1.54	5.48	8.72	13.4
Visten-C	Ultraviolet	0.09	2.34	2.71	3.02
	Soft white	0.11	1.57	2.35	2.58
None (unpackaged)	Ultraviolet	34.0	55.6	62.8	65.4
	Soft white	34.4	60.9	63.7	66.3

[1] Weight losses expressed as % initial wet weight; means of four samples. Relative humidity 40 to 75%. Temperature 2.5° ± 1. Dimensions of samples: 1½ x 1½ x ½".

Desiccation appeared to play an important role in causing discoloration of cellophane-wrapped beef exposed to ultraviolet radiation. Moisture content of samples stored for 12 days was calculated to be about 50% of the wet weight, which provided a reduced relative humidity at the meat surface *(5, 12)*. It has been stated *(2)* that affinity of proteins for water is decreased as a result of denaturation by ultraviolet radiation. This may partly explain the excessive dehydration of cellophane-wrapped beef exposed to germicidal ultraviolet light. When wrapped in MSAT-80 cellophane, moisture losses were less severe with display under fluorescent light than with exposure to ultraviolet light. With the use of the less transparent, less moisture-permeable Visten-C film, there were only slight weight losses with either type of light.

When fresh beef was packaged with polyethylene laminated to cellophane, inappreciable differences in color and reflectance were demonstrated by meat held in the dark or exposed to 70 footcandles of Soft White fluorescent light. In Figure 6 reflectance curves are shown for samples displayed under light and for those stored in the dark. Values for spectral reflectance at each of the wavelengths indicated are computed as the means of determinations made at 2, 4, and 12 days. Beef stored in the absence of light gave slightly higher reflectance values than those obtained from similar meat exposed to light. By inspection, however, the variation between the two curves is no more than that which was found before storage (Figure 1). In either the presence

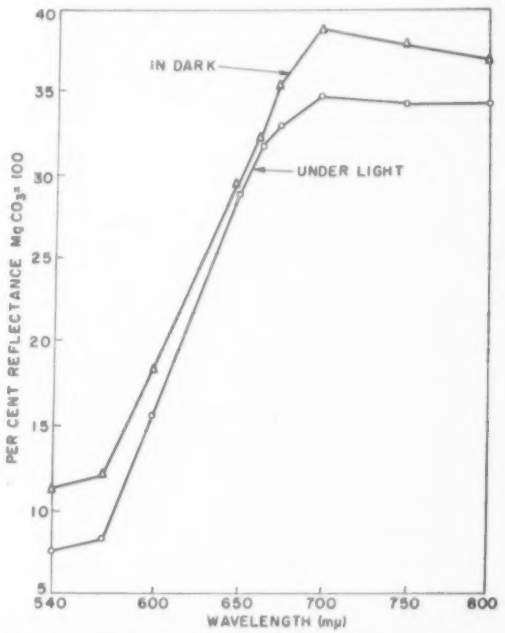


Figure 6. Effect of light intensity * on reflectance of beef packaged with polyethylene laminated to cellophane.

* Light intensity 70 footcandles of Soft White fluorescent light. Each point is the mean of reflectance at 2, 4, and 12 days.

or absence of light, reflectance of stored meat was shifted to values lower than those demonstrated by freshly cut bright red beef.

Further studies were conducted in order to evaluate the influence of high and low intensities of Soft White fluorescent light on discoloration of packaged beef. As indicated in Figure 7, reflectance of beef wrapped with MSAT-80 cellophane and stored at a light intensity of 150 footcandles differed little from that of similarly packaged beef exposed to 50 footcandles of Soft White fluorescent light. Changes in color were also in good agreement and corresponded to those observed when cellophane-wrapped beef was stored in the dark.

In the present study, and in previous experiments *(6)*, surface bacterial counts were approximately 10^7 organisms per sq. cm. when off-odor became apparent. The beef samples were not inoculated. The bacterial flora present prior to storage represented only that native to the meat at the time that it was cut and wrapped. Bacterial growth curves obtained from meat wrapped with the same type of materials employed in studies concerning discoloration are given in Figure 8. Few differences were found in numbers of survivors exposed to 50 footcandles as compared to 150 footcandles of Soft White fluorescent light.

Figure 8 demonstrates that bacterial numbers on beef wrapped with Visten-C decreased during storage for 2

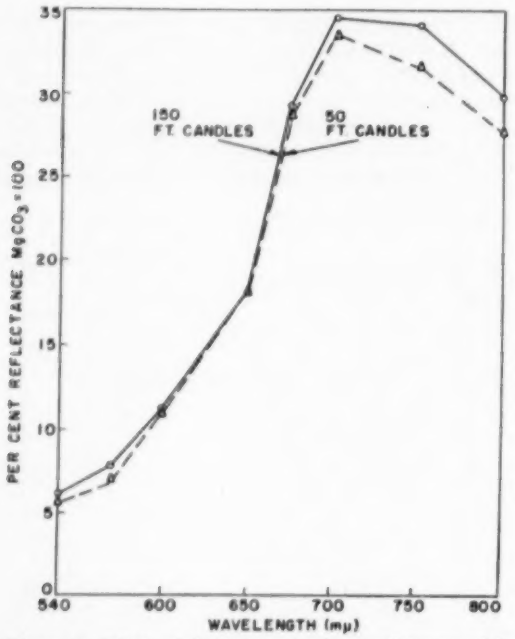


Figure 7. Effect of light intensity * on reflectance of beef packaged with MSAT-80 cellophane.

* Each point is the mean of reflectance for four samples measured at 2, 5, 8, and 12 days.

days. Reflectance values declined during this early phase of storage and the color of samples changed from bright red to purple-brown (Figure 5). Also, beef packaged with MSAT-80 cellophane had fewer surface organisms at the end of 2 days of storage than were found initially; these samples exhibited discoloration (Figure 4).

The action of germicidal ultraviolet light in reducing surface bacterial growth on packaged beef was dependent upon the ability of the materials to transmit this kind of light. When MSAT-80 cellophane served as the wrapper, growth of surface bacteria on packaged beef was greatly retarded. In later phases of storage, further inhibition of bacterial development may have been due partly to desiccation. Also, increase in transparency of the film to ultraviolet light probably resulted on prolonged exposure. With Visten-C, which was shown to be less transparent than cellophane to light of short wavelengths, little difference was observed in counts made from samples held under ultraviolet when compared with those exposed to fluorescent lights. However, during the initial growth phase, numbers of organisms decreased more markedly upon exposure to ultraviolet radiation than they did with display under Soft White fluorescent light. At the end of the eighth day in storage, off-odor was detected on beef wrapped with Visten-C and held under either type of illumination.

Surface bacterial counts were somewhat erratic and no definite trend in development of organisms was observed (Table 2). Freezing temperatures were approached during storage and under these conditions the numbers of bacteria remained relatively low. From the observations of experiments performed during this study, it would appear that the bacterial flora was incidental to the discoloring phenomenon.

TABLE 2

Bacterial counts from packaged beef exposed to 50 and 150 footcandles of Soft White fluorescent light [1]

Packaging material	No. of samplings	Days in storage	Light intensity (ft. candles)	
			50	150
			Average bact. count/sq. cm.	
MSAT-80 cellophane	8	0	650	650
		2	800	1500
		5	670	1300
		8	2300	1100
		12	1800	730
		21	220	2400
Philofilm FF-120	2	0	980	980
		2	11000	6800
		5	5000	20000
		8	3000	13000
		12	2700	11000
Polystyrene Q-641	2	0	980	980
		2	23000	24000
		5	8900	5300
		8	3500	4900
		12	6500	3000

[1] Storage conditions: Victor refrigerator with top open. Temperature 1.5° C. ± 1°. Relative humidity 50 to 65%.

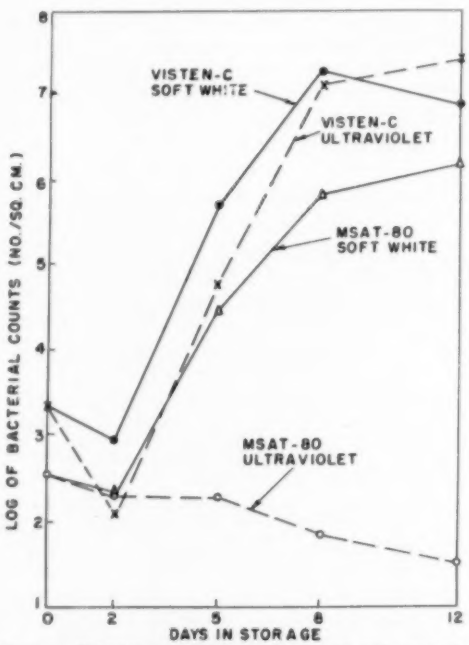


Figure 8. Relation of packaging materials and type of light to bacterial growth * on beef.

* Each point is a logarithmic average of counts obtained from four samplings of beef.

SUMMARY AND CONCLUSIONS

It has been recognized for some time that ultraviolet radiations exert a germicidal effect and that these radiations also cause oxidation of the myoglobin of fresh meats. However, no work has been reported on the action of germicidal ultraviolet light in causing desiccation of fresh meats. In the present study it was found that irradiation of cellophane-wrapped beef with ultraviolet light produced marked dehydration of the meat. Further, loss of moisture resulting from irradiation appeared to be responsible for much of the darkening of the meat pigment and for retardation of surface bacterial growth.

Although only two materials were tested using germicidal ultraviolet light, results indicate that benefits derived from reduction in bacterial counts are nullified by accompanying darkening of color and desiccation. The extent to which these changes occurred depended in large measure on the properties of packaging films. Light transmission, permeability to moisture vapor and gases, and stability to ultraviolet radiation are some characteristics of materials that affected discoloration and development of surface organisms on beef exposed to germicidal ultraviolet radiations. Application of ultraviolet light in self-service display cases does not appear to be practical for control of microbial growth on packaged beef. Measurements of spectral reflectance and visible color changes indicated that ultraviolet light caused rapid oxidation of myoglobin to produce marked discoloration of fresh beef early in storage, whereas similar discoloration with display under fluorescent light required a longer period of time and resulted from a combination of desiccation of the meat and oxidation of the pigment.

Intensity of Soft White fluorescent light was unimportant in influencing the course of discoloration of packaged fresh beef. Also, intensity of visible light did not affect development of surface organisms on such meat. From the practical aspect, display of fresh meat in self-service markets could be carried out using high intensities of Soft White fluorescent light without the occurrence of undue discoloration.

LITERATURE CITED

1. Butler, O. D., Bratzler, L. J., and Mallmann, W. L. The effect of bacteria on the color of prepackaged retail beef cuts. *Food Technol.*, **7**, 397-400 (1953).
2. Duggar, B. M. *Biological Effects of Radiation.* Vol. I. 1936, McGraw-Hill Book Co., Inc., New York.
3. Ewell, A. W. Researches on ultraviolet light and ozone and their relations as germicidal agents. *Refrig. Eng.*, **41**, 331-334 (1941).
4. James, R. F. Mold and bacteria killed by new lamp. *Food Inds.*, **8**, 295-297 (1936).
5. Kefford, J. F. Effect of ozone on microbial growth on beef muscle, and on the flavour of beef fat. (Australia) *J. Council Sci. Ind. Research*, **21**, 116-140 (1948).
6. Kraft, A. A., and Ayres, John C. Post-mortem changes in stored meats. IV. Effect of packaging materials on keeping quality of self-service meats. *Food Technol.*, **6**, 8-12 (1952).
7. Lea, C. H., and Lea, D. E. The transmission of light of wavelength 2536 A by fats. (Gr. Brit.) Dept. Sci. Ind. Research, *Rep. Food Invest. Board*, 1936, p. 36-37 (1937).
8. Oser, B. L. How foods spoil. *Food Inds.*, **18**, 1683-1685, 1822, 1824, 1826, 1828 (1946).
9. Pracejus, W. G. A report on meat fading. *Engineers Bull.*, Lamp Dept., General Electric Co. (June, 1949).
10. Pride, G. E. A reflectance measuring attachment for the Beckman spectrophotometer. *J. Optical Soc. Am.*, **36**, 510-513 (1946).
11. Ramsbottom, J. M., Goeser, P. A., and Schultz, H. W. How light discolors meat: what to do about it. *Food Inds.*, **23**, 120-124, *222* (1951).
12. Scott, W. J. The growth of micro-organisms on ox muscle. I. The influence of water content of substrate on rate of growth at —1° C. (Australia). *J. Council Sci. Ind. Research*, **9**, 177-190 (1936).

Flavor Studies of Canned Single Strength Orange Juice

RICHARD B. GUYER and JOHN M. BOYD

Research Division, Continental Can Company, Inc., Chicago, Illinois

(Manuscript received November 4, 1953)

An investigation was undertaken to determine the effect of the removal of the peel oil at the time of canning with subsequent reconstitution at the time of consumption on the flavor of canned single strength orange juice. Results indicate that the flavor of orange juice packed with a very low oil content deteriorates as rapidly as that of orange juice packed with a normal oil content and that the addition of peel oil at the time of consumption slightly improved the flavor. The temperature of storage was found to be the most important single factor in preventing the deterioration of the flavor of canned single strength orange juice.

Deterioration or instability of the flavor during storage continues to be a major problem with canned single strength orange juice. A number of investigations have been reported on this particular problem with the result that several theories have been advanced as to its cause. Swift *(6)* states these theories fall into three main categories; namely, that the off-flavors are caused by oxidation due to inclusion of atmospheric oxygen in the can, by changes in the peel oil constituents, or by changes in the lipid constituents.

Boyd and Peterson *(2)* and later Henry and Clifcorn *(3)* investigated the role of oxygen and the deterioration of flavor in canned orange juice. Their investigations showed that while the removal of atmospheric oxygen is of some importance in initially preventing deterioration, it is not the main factor in off-flavor development.

A number of investigators have studied the changes in juice lipids since there is a possibility that changes in the lipid fraction of the juice might give rise to the off-flavors developed during storage. Huskins, Swift, and Veldhuis *(4)* studied the effect of aging on the composition of the lipids. They found that the noteworthy changes which occurred were in the contents of phosphorus and nitrogen. Phosphorus was found to decrease to one-tenth of its original value on storage at room temperature for two years, and nitrogen to one-fifth of its original value. They further stated that the phosphatide fraction appeared to break down on storage, freeing the nitrogen compounds which might have reacted with some constituents of the aqueous part of the juice to form the objectionable flavor. In later experiments Swift *(6)* reported that added phosphatide, choline, and ethanolamine had little effect on the flavor after storage for 14 weeks between 32° and 41° F. or at 80° F.

A third group of investigations has been based on the

premise that changes in the peel oil constituents are responsible for deterioration of flavor during storage. Boyd and Peterson *(2)* stated that the presence of volatile oil in fresh orange juice gave it a pleasant aroma and added to the flavor. However, under certain conditions, they found that the presence of even small amounts of oil in canned orange juice on prolonged storage gave rise to objectionable off-flavors. Blair and co-workers *(1)* have proposed that the deterioration in flavor of canned orange juice in warm storage is complex, and they differentiated between a "terebinthine" flavor factor and other complex factors designated collectively as "staleness." They presented evidence to show that the "terebinthine" flavor factor is due to instability of peel oil components when mixed with acid juice. They further showed that the instability was very much a function of temperature, becoming predominant, during a normal storage period, only above 70° F. Swift *(6)*, in summarizing the investigations on this problem, concludes that the bulk of evidence seems to indicate that peel oil is the source of the typical flavor that develops in orange juice during storage. However, he also states that it is not yet clear whether the terpene fraction of the oils is responsible or whether the lipid constituents play a role.

The study reported in this paper is from investigations conducted during two citrus seasons and is based on the assumption that peel oil or some fraction thereof is responsible for the flavor deterioration. It was reasoned that if some fraction of the peel oil were responsible, then removal of the oil at the time of packing—with subsequent reconstitution at time of consumption—should help eliminate the undesirable off-flavor.

PROCEDURE

The juice from cleaned and inspected Valencia oranges was extracted on both Rotary Juice-Press and Citro-Mat equipment. After extraction and finishing, the juice was pumped through stainless steel pipes to a large stainless steel blending tank. All of the fruit was extracted prior to the experimental runs so that each variable would have the same raw product origin. The juice for each variable was then passed through a low temperature-high vacuum deaerator-deoiler to obtain the desired oil level. The oil levels obtained were 0.0016%, 0.0095%, and 0.0125%. In addition, oranges were steamed and hand peeled as if for sectionizing and the juice extracted with the Citro-Mat. There was no detectable volatile oil in the juice extracted in this manner.

After passing through the deaerator the juice was pumped through a tubular heat-exchanger where it was flash pasteurized at 200°-205° F. (93.33°-96.11° C.) for approximately 20 seconds. After heating, the pasteurized juice flowed to a 24-valve juice filler where the No. 2 cans were filled at approximately 195° F. (90.56° C.). The closed cans were then passed through a spin-cooler to obtain a center temperature of approximately 100° F. (37.78° C.). Samples of each variable were then stored at room temperature, 35° F. (1.67° C.), and —10° F. (—23.33° C.).

The volatile oil content was determined by a standard steam distillation procedure as recommended by Wilson *(7)*. The method was modified to conduct the test on a 2-liter sample with refluxing at the rate of 30 drops per minute for a period of approximately two hours.

The evaluation of all samples was based on periodic taste panel tests at the canning oil level and at the reconstituted oil level of 0.025%. A good grade of cold pressed orange oil was used to bring the oil content to the desired level. The same lot of orange oil was used for all examinations.

The taste panel was made up of 10 experienced members who judged each sample twice during the course of an examination so that approximately 20 judgments were made on each sample at each of the periodic examinations. Four to 6 samples were given a judge at one time. These samples were presented so that it was possible to make direct comparisons between both peel oil variables and temperature variables. The tasters were asked to judge the samples as to their acceptability and to give them numerical grades in accordance with the following scale:

100—Perfect	40-45—Fair
90-95—Excellent	30-35—Poor (Borderline acceptable)
80-85—Extremely Good	20-25—Very Poor (Unmerchantable)
70-75—Very Good	10-15—Extremely Poor
60-65—Good	0- 5—Inedible
50-55—Average	

RESULTS AND DISCUSSION

Storage temperature was found to be the most important factor in maintaining the flavor of single strength orange juice over a prolonged storage period. As shown in Figure 1 the flavor of the canned orange

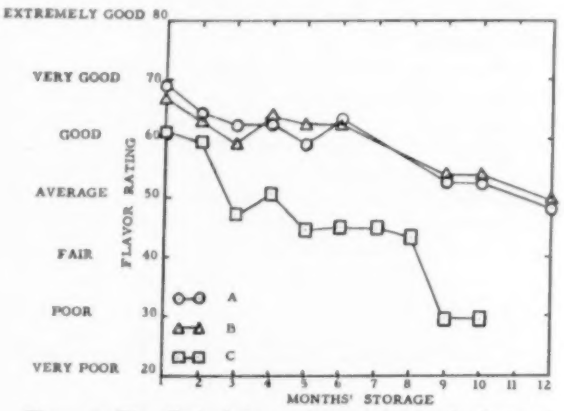


Figure 1. The effect of storage temperature on the flavor of single strength orange juice. (A) —10° F.; (B) 35° F.; (C) Room Temperature.

juice stored at room temperature deteriorated rapidly from a rating of *good*, one month after packing, to a rating of *poor* to *extremely poor*, at the end of 9 months. At this point the variables stored at room temperature were considered to be unmerchantable by a majority of the members of the taste panel.

No significant difference was noted between the flavor of the canned orange juice stored at —10° F. (—23.33° C.) and that stored at 35° F. (1.67° C.). However, in both cases there was a gradual deterioration of the flavor over a twelve-month storage period from *very good* to *slightly above average*.

These results are in agreement with the investigations of Boyd and Peterson *(2)* who state that storage temperature of canned orange juice is a very important factor in the prevention of loss in flavor. Riester, Braun and Pearce *(5)* also state that the rate of general quality deterioration is correlated with the temperature of storage.

The results presented in Table 1 show the effect of oil level and added cold pressed orange oil on the flavor of single strength orange juice. The flavor rating is presented for each variable after one and 12 months' storage at —10° F. (—23.33° C.) and 35° F. (1.67° C.). The flavor ratings of the variables stored at

TABLE 1

The effect of oil level and added cold pressed orange oil on the flavor of single strength orange juice

Oil Level	—10° F. Storage			35° F. Storage			Room Temperature Storage		
	1 Month	12 Months	Avg. of All Tests	1 Month	12 Months	Avg. of All Tests	1 Month	9 Months	Avg. of All Tests
.0125%	66.9	52.5	61.0	75.5	50.0	61.8	56.8	29.1	44.2
.0095%	69.3	48.9	60.2	68.3	49.8	59.6	63.1	26.9	44.0
.0016%	63.8	43.2	53.7	58.4	47.2	53.0	53.8	27.8	38.7
.0125% raised to .025% at time of flavor test	65.0	45.5	59.5	69.5	47.5	61.7	65.0	29.7	48.5
.0095% raised to .025% at time of flavor test	69.3	52.0	62.1	71.2	50.5	60.3	63.7	32.1	48.8
.0016% raised to .025% at time of flavor test	66.2	52.0	59.1	71.2	44.2	58.2	65.0	32.1	48.2
L. S. D. @ 5% Level			2.3			2.3			2.5

room temperature were taken from the one and 9 months examinations. At the end of 9 months the variables stored at room temperature were considered unmerchantable and, therefore, no further examinations were made on these samples. The averages presented in Table 1 represent the averages for all examinations made on the variables at the various storage temperatures. Nine examinations were made over a period of 12 months on the variables stored at 35° F. (1.67° C.) and —10° F. (—23.33° C.).

When the samples were tasted before adding the peel oil, those samples containing 0.0125% and 0.0095% peel oil were rated higher than the lowest oil-containing sample (0.0016%) and the oil-free juice. The addition of peel oil at the time of tasting did improve the flavor, but as shown in Figure 2, the resulting rating was far below that of the control stored at 35° F. (1.67° C.). It was the opinion of the panel that added peel oil tended to mask the off-flavor. However, as the flavor deterioration became more pronounced the off-flavor could easily be detected.

Samples from hand-peeled fruit which had no detectable oil content deteriorated at a rate similar to the variable containing 0.0016% peel oil. In both cases the addition of peel oil at the time of consumption did improve the flavor, but did not bring it back to the level of the control stored at 35° F. (1.67° C.).

This investigation has shown that the flavor of canned single strength orange juice stored at room temperature continued to deteriorate as rapidly with only 0.0016% peel oil present as it did with 0.0125% peel oil present.

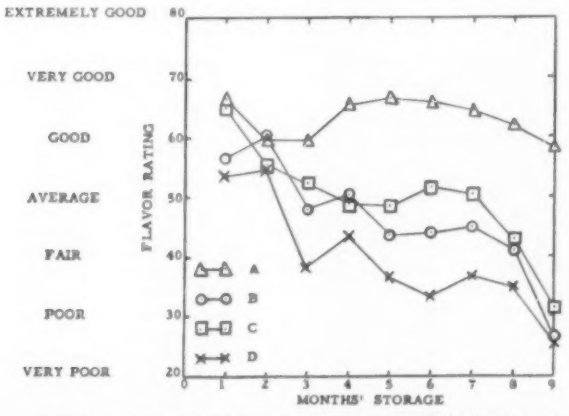


Figure 2. Flavor Ratings, over a nine months' storage period, of single strength orange juice containing various amounts of orange oil. (A) Control 35° F.; (B) Room Temperature, 0.0125% Oil; (C) Room Temperature, 0.0016% oil + added oil; (D) Room Temperature, 0.0016% oil.

In addition, it has shown that the addition of cold pressed orange oil to a low oil-containing sample at the time of consumption did improve the flavor over that of a sample containing a normal amount of oil during the storage period. However, even with this improvement the flavor was considered significantly less acceptable than the control stored at 35° F. These results would seem to indicate that some factor or combination of factors other than peel oil is involved in the development of off-flavor in canned single strength orange juice during storage.

SUMMARY

An investigation was undertaken to determine the effect of the removal of the peel oil at the time of canning with subsequent reconstitution at the time of consumption on the flavor of canned single strength orange juice. This investigation was based upon the assumption that peel oil or some constituent thereof was responsible for the deterioration or instability (during storage) of the flavor of canned single strength orange juice.

The results indicate that when orange juice is packed with a very low oil content, the flavor deteriorates as rapidly as orange juice packed with a normal oil content. When cold pressed peel oil was added at the time of consumption, there was a slight improvement in flavor, but the flavor was considerably less desirable than controls stored at 35° F. (1.67° C.).

The temperature of storage was found to be by far the most important single factor in preventing the deterioration of the flavor of canned single strength orange juice.

LITERATURE CITED

1. Blair, J. S., Gadar, E. M., Masters, J. E., and Riester, D. W. Exploratory experiments to identify some of the chemical reactions causing flavor deterioration during storage of canned orange juice. I. Incompatibility of peel-oil constituents with the acid juice. *Food Research*, **17**, 235-260 (1952).

2. Boyd, J. M., and Peterson, G. T. Quality of canned orange juice. *Ind. Eng. Chem.*, **37**, 370-373 (1945).

3. Henry, R. E., and Clifcorn, L. E. The problem of deterioration in flavor of canned orange juice. Supplement to National Canners Association Information Bulletin No. 1170, Jan. 1948.

4. Huskins, C. W., Swift, L. J., and Veldhuis, M. K. Constitution of the lipid from stored Valencia orange juice. *Food Research* **17**, 109 (1952).

5. Riester, D. W., Braun, O. G., and Pearce, W. E. Why canned citrus juices deteriorate in storage. *Food Inds.*, **17**, 742-744 (1945).

6. Swift, L. J. Flavor changes in stored canned orange juice. *Proc. Florida State Hort. Soc.*, **64**, 181-185 (1952).

7. Wilson, J. B. Determination of peel oil in citrus juices. *J. Assoc. Offic. Agr. Chem.*, **27**, 201 (1944).

Thermal Processes for Pimientos Canned in Glass Jars[a]

WILLAMINTA N. HIGHT, DAN E. PRATT, AND JOHN J. POWERS
Department of Food Technology, University of Georgia, Athens, Georgia

(Manuscript received January 18, 1954)

A facultative aerobe (identified as probably Bacillus cereus) was isolated from spoiled canned pimientos and was demonstrated to be a causative agent of such spoilage. The thermal death characteristics were determined in pimiento puree at pH 5.0 and 4.7 and subcultured in pimiento puree at pH 5.0 and 4.7 tryptone-dextrose-yeast evtract broth, and pork-spleen broth. The F_{212} and z values of this bacterium in pimiento puree at pH 5.0 were 36.0 and 31.0, respectively; at pH 4.7 the F_{212} and z values were 7.0 and 4.2, respectively.

Factors influencing the processing of canned pimientos *(7, 13, 17, 20)*, rates of heat penetration *(14, 21)*, and suggested processes *(4)* have been reported by various investigators. In the commercial canning industry the amount of spoilage is probably less than ever before; nevertheless some spoilage is occasionally reported. Although less is known about the amount of spoilage that results when pimientos are canned in community canneries, the processes in use are far less severe than those used by the commercial industry. The study reported herein was undertaken: (a) to determine the thermal-death-time (T.D.T.) characteristics of microorganisms causing spoilage in the commercial industry and (b) to derive processing times for use in community canneries. Pimientos are not listed in the latest U.S.D.A. bulletin on community canning *(11)*, in part perhaps because they are not important nationally and in part because data were not available upon which to make processing recommendations. In other publications, including one published by this laboratory before the pimiento studies listed above were initiated, the processing times suggested are probably inadequate *(3, 12)*.

EXPERIMENTAL

Preparation of spore suspension. Spoilage organisms were isolated from commercially-canned spoiled pimientos according to the procedure given in *Methods of Analysis* (A.O.A.C.) *(1)*. Inoculations were made into tubes of tryptone-dextrose broth and the tubes heated in boiling water for various lengths of time to destroy vegetative cells and spores with low-heat resistance. Inocula frim the 12 most resistant cultures were transferred to pork-extract medium. The spore crops were prepared on pork extract medium by the procedure of the National Canners Association *(2)*. Spore counts were made anaerobically on pork-extract agar.

Thermal death time determination. Thermal-death-time tubes were made of Pyrex tubing seven inches long with 7 mm. inside diameter and 9 mm. outside diameter. Two ml. of pimientos that had been pureed in a Waring blender and inoculated with 10,000 spores per ml. were filled into the T.D.T. tubes. The sealed tubes were submerged in a constant-temperature oil bath. At predetermined increments of time a selected number of tubes were removed from the oil bath and placed in ice water. Contents of the tubes were subcultured in pimiento puree at pH 5.0 and 4.7, tryptone-dextrose-yeast broth, and pork-spleen broth *(10)* to determine product inhibition points and the maximal points of growth in media readily supporting germination. The contents of the T.D.T. tubes heated at 210° F., 220° F. and 230° F. were subcultured in the pimiento puree; the contents of tubes heated at 230° F., 240° F. and 250° F. were subcultured into tryptone-dextrose-yeast broth and pork spleen media. Initially 6 tubes each were run at 2-minute intervals for each temperature and each subculture medium; subsequent runs were made at one minute intervals using 6 tubes for each time, temperature, and subculture medium. In the final runs 10 tubes each were used at one-half minute intervals for each temperature and subculture medium.

The heating rates of the puree in the T.D.T. tubes were determined at each temperature by placing a thermocouple at the "cold spot" of the tube. The heating and cooling lags at each temperature were calculated by Ball's method *(5)* so that the heat lag could be deducted from the actual heating period to yield the equivalent time at each temperature *(15)*. The lag varied from 1.32 to 2.20 minutes. The subcultures were inoculated at 37° C. (98.6° F.) for approximately 4 months. The survival destruction points were plotted on semi-log paper in order to determine F (sterilization time at 250° F.), F_{212} (sterilization time at 212° F.) and z (slope of the T.D.T. curve).

Heat penetration. Heat Penetration studies were made on pimientos packed in pint (304 x 503) and half-pint (303 x 301) jars. The thermocouple assembly has been previously described by the authors *(14)*. All heat penetration studies were made at the "cold spot" of the jars, as determined experimentally. An atmosphere cooker was used to process all jars used in heat penetration studies.

At 5-minute intervals, from 25 to 85 minutes for pint jars and from 10 to 60 minutes for half-pint jars, 6 jars of pimientos inoculated with 20,000 spores at the "cold spot" and 6 uninoculated controls were put up. The pH of all pimientos used in the inoculated packs and the uninoculated controls was adjusted to 5.0. The canned pimientos were stored at room temperature for 3 months.

RESULTS AND DISCUSSION

The T.D.T. characteristics of 12 spore-forming cultures isolated from various cans of spoiled pimientos were studied. Table 1 shows the F_{212}, F, and z values of the most heat-resistant culture studied. Except at times near the point of maximal growth, subcultured tubes in general were consistently positive at each temperature.

The T.D.T. characteristics of the 11 remaining bacteria are not reported since the thermal resistance of none of them was as great as that of the organism described below. The organism used in this study was a facultative aerobe. After the usual isolation and purification techniques, the culture appeared to be pure; upon inoculation into pimiento, rapid and typical gaseous spoilage was produced under anaerobic conditions. After some months of propagation on tryptone-dextrose-yeast and pork-extract media, the spores lost their ability to produce gas when grown anaerobically and two biotypes became evident. Both biotypes were identified by the Communicable Disease Center, U. S. Public Health Service, Chamblee, Georgia, as probably being variants of *Bacillus cereus*. The 2 biotypes varied from the characteristics of *Bacillus cereus* only in their inability to hydrolyze starch. Upon being grown under aerobic conditions

[a] Contribution from the College Experiment Station, University of Georgia, Athens, Georgia, approved as Journal Paper No. 11. The work reported is a portion of a thesis submitted to the Graduate Faculty of the University of Georgia by Mrs. Willaminta N. Hight in partial fulfillment of the requirements for the degree, Master of Science in Agriculture.

TABLE 1

Thermal death time curve characteristics

T. D. T. Tube Contents	Subcultured in Pimiento Puree				Subcultured in		Subcultured in	
	pH 4.7		pH 5.0		Pork-Spleen Broth		Tryptone-Dextrose Broth	
	F_{212}	z	F_{212}	z	F	z	F	z
Pimiento Puree [1] pH 5.0	.....	.....	36.0	31.0	8.1	12.5	12.3	25.0
Pimiento Puree [1] pH 4.7	7.0	4.2	.....	.....	.....[2]	.....[2]	11.8	15.9

[1] Inoculated at 10,000 spores per milliliter.

[2] At pH 4.7, growth occurred at 27.8 minutes at 250° F., the maximum time used.

for several transfers, first in proteose-peptone medium, then in pimiento puree, the gas-producing ability of the organism was generally restored. This is similar to the findings of Becker and Pederson *(6)* and Stern, Hegarty, and Williams *(19)*. These authors studying the action of *Bacillus coagulans (Bacillus thermoacidurans)* in tomato juice found that CO_2 was readily produced under aerobic conditions but only minute amounts of the gas were produced anaerobically. The work of Stern *et al. (19)* also demonstrated that repeated transfers were required to develop cultures of *Bacillus coagulans* that would cause spoilage in tomato juice. The characteristics and tendency of aerobic, mesophilic, spore-forming bacteria to form variants are described in detail by Smith, Gorden, and Clark *(18)*. All thermal resistance determinations and inoculated pack data were secured prior to the loss of the original, typical fermentative characteristics. Although extensive measurements were not made, the thermal resistance of cultures which regained their gas-producing ability appeared to be the same as originally.

A summary of the data obtained from the heat penetration studies is shown in Table 2. The values reported are based on the temperature at the "cold spot" and the T.D.T. curve characteristics of *Bacillus* sp. *(cereus?)* subcultured into pimiento puree at pH 5.0. The F_{212} values shown in Table 2 were calculated for pimientos at pH 5.0 since that pH is close to the upper end of the usual pH range *(17)* and maximum thermal resistance (and thereby processing times) exist. Calculated processes were also derived from the T.D.T. data for pimientos acidified to pH 4.7.

TABLE 2

Summarization of heat penetration data of canned pimientos processed in half-pint (303 x 301) and pint (304 x 503) jars at 212° F.

Heat Penetration Data [1]						F_{212} Values [2]	
CUT	IT	j	f_h	f_z	x_{bh}	Heating	Cooling
Half-Pints (303 x 301) (F_{212} values reported are for a 65 minute process)							
2	128	2.66	27.5	.....	.....	35.8	2.3
4	116	1.73	24.0	14.0	28.8	41.6	0.1
4	111	1.55	31.0	19.3	32.2	36.0	1.4
Composite curve (slowest heating and fastest cooling jar of 13 determinations)						35.8	0.1
Pints (304 x 503) (F_{212} values reported are for an 85 minute process)							
5	124	1.18	44.5	.....	.....	35.0	5.4
4	116	2.25	36.0	20.0	41.0	48.2	1.2
4	108	2.35	33.8	19.3	34.0	47.2	4.7
Composite curve (slowest heating and fastest cooling jar of 11 determinations)						35.0	1.2

[1] Explanation of abbreviations used:

CUT — The time required for the atmospheric cooker to reach the temperature of the process.

IT — The initial temperature at the "cold spot."

j — A number representing the time lag before the heating curve assumes a straight time on semi-logarithmic paper.

f_h — The slope of the heat penetration curve.

f_z — The second slope of the heat penetration curve.

x_{bh} — The number of minutes from the beginning of the process to the point of break in the heating curve.

[2] Lethalities derived from T.D.T. data (in pimiento puree at pH 5.0).

At pH 5.0, calculated processes for half-pint and pint jars were, respectively, 65 and 85 minutes at 100° C. (212° F.). At pH 4.7, the respective processes were 40 and 50 minutes at 100° C. (212° F.).

The respective F_{212} values for the half-pint and pint jars were 27.1 and 12.1 at the highest points of spoilage. Application of the T.D.T. data of this study to the heat-penetration data of Wessel and Roberts *(21)* and processes of 50 and 65 minutes suggested by the National Canners Association *(4)* for 7-ounce and 14-ounce cans of pimientos indicate that lethal levels of 27.3 and 24.6 be secured in 7-ounce and 14-ounce commercial cans of pimientos. The results of the inoculated packs line up fairly well with commercial experience. The fact that spoilage of pimientos in half-pint jars occurred at a higher level than in pint jars is explainable in part upon the basis of the difference in average spore concentration, i.e., 44 versus 89 spores per ml. and, probably to a greater extent, by the normal variance of heating rates. The discrepancy between the lethality value (F_{212}) of 36.0 in thermal death time tubes and 27.1 in 8-ounce jars may also be partially explained by the difference in spore concentration and by the difference in substrate between pimiento puree and unpureed pimientos; Reed, Bohrer, and Cameron *(16)* found that the F values of F.S. 1518, T.A. 3814, and P.A. 3679 were usually greater in purees of beans, peas, and spinach than the brine of the unpureed vegetable.

Processing times for red pimientos in community canning centers are sometimes as low as 20 minutes in boiling water for pint jars and No. 2 cans. Such processing times are not sufficient to destroy a number of bacteria which have been demonstrated to grow in pimientos, and in the light of a recent outbreak of botulism in an acid food in Georgia *(8, 9)* the 20-minute process for a food, the pH of which may exceed 5.0 *(17)*, is subject to suspicion. However, the concentration of spores used in the work reported herein was probably much greater than the number of spores usually contaminating canned pimientos. In view of the fact that no uninoculated pack of pimientos spoiled, the problem may be one primarily of sanitation.

The slopes of the f_z curves were all steeper than the f_h curves. This indicates that the initial conduction heating changed to convection heating in the latter stages of the process. Such a phenomenon may easily be explained because pimientos are packed without liquid yet enough liquid usually diffuses from the peppers to nearly cover the contents of the container during the process. In an earlier article, the authors *(14)* reported a similar change in the mode of heat transfer in canned tomatoes.

SUMMARY

A facultative aerobe (tentatively identified as *Bacillus cereus*) was isolated from spoiled commercially-canned pimientos. This bacterium was the most heat resistant of 12 organisms studied that would cause spoilage in canned pimientos. The thermal death characteristic of this organism were determined at pH 5.0 and 4.7. The F_{212} and z values were 36.0 and 31.0, respectively, when subcultured in pimiento puree at pH 5.0; at pH 4.7, the F_{212} and z value were respectively 7.0 and 4.2.

Based on the T.D.T. characteristic of this organism and heat penetration determinations, the processing times of half-pints and pints of pimientos would be 65 and 85 minutes, respectively, at 100° C. (212° F.). These processing times, however, were not verified by the results of the experimental packs and more experimentation will have to be done before such processing time-temperature relationships are accepted as conclusive.

Acknowledgments

The authors gratefully acknowledge the aid of Dr. Martha K. Ward and Miss Elizabeth O. King, Bacteriologists, Communicable Disease Center, Chamblee, Georgia, for identifying the bacterium reported in this study. Dr. Martin W. Frobisher, former head of the Department of Bacteriology, University of Georgia, and former Chief of the Communicable Disease Center arranged for the identification. Appreciation is also expressed to Dewey and Almy Company, Cambridge, Mass., whose compound, DAREX Cap compound 71C, used as a coating prolonged the life of thermocouple assemblies.

LITERATURE CITED

1. Association of Official Agricultural Chemists. *Methods of Analysis.* 7th ed., 1950, 741-742.
2. Anonymous. Preparation of spore suspensions. National Canners Association Method (putrefactive anaerobes, such as N. C. A. No. 3679) National Canners Association, Washington, D. C.
3. Anonymous. Canning procedures. Univ. of Georgia, College of Education, *Bull.*, **29**, 19 (1948).
4. Anonymous. Processing studies on red pimientos. *Canning Trade*, **71**, (No. 44), 6 (1949).
5. Ball, C. O. Mathematical solutions of problems on thermal processing of canned foods. Univ. of Calif., *Pubs. Public Health*, **1** (2) 15 (1928).
6. Becker, M. E., and Pederson, C. S. The physiological characters of *Bacillus coagulans (Bacillus thermoacidurans)*. *J. Bact.*, **59**, 717 (1950).
7. Hight, Willaminta N. A study of factors which determine the processing requirements for canned pimientos and snap beans. (Master's Thesis, Univ. of Ga., 1953).
8. Hight, Willaminta N., and Powers, J. J. Botulism outbreak in Georgia. Univ. of Georgia, College Expt. Sta., *Information Leaflet No. 3* (1953).
9. McCroan, J. E., Jr. (Personal communication to Mrs. Willaminta N. Hight, 1953).
10. Mundt, Orvin J. (Personal communication to John J. Powers, 1951).
11. Olsen, Bertha F., and Scott, Esther H. Canning in glass jars in community canning centers. U.S. Department of Agriculture, *Agr. Handbook No. 44* (1952).
12. Powers, J. J., and Mills, W. C. Technical manual for community canning plant operators. Univ. of Georgia, Dept. of Food Technology, *Bull. No. 2* (1948).
13. Powers, J. J., Morse, R. E., Sane, Ruth H., and Mills, W. C. Acidification and calcium-firming of canned pimientos. *Food Technol.*, **4**, 485 (1950).
14. Powers, J. J., Pratt, D. E., and Norris (Hight), Willaminta. Comparative heating rates of bentonite suspensions in jars processed in water and in steam at atmospheric pressure. *Food Technol.*, **6**, 246 (1952).
15. Pratt, D. E., and Powers, J. J. The thermal destruction of pectic enzymes in grapefruit juice. *Food Research*, **18**, 152 (1953).
16. Reed, J. M., Bohrer, C. W., and Cameron, E. J. Spore destruction rate studies on organisms of significance in the processing of canned foods. *Food Research*, **16**, 383-408 (1951).
17. Sane, Ruth H., Powers, J. J., Morse, R. E., and Mills, W. C. The pH and total acidity of raw and canned pimientos. *Food Technol.*, **4**, 279 (1950).
18. Smith, N. R., Gordon, Ruth E., and Clark, F. E. Aerobic mesophilic sporeforming bacteria. U. S. Department of Agriculture *Misc. Pub. No. 559* (1946).
19. Stern, R. M., Hegarty, C. P., and Williams, O. B. Detection of *Bacillus thermoacidurans* (Berry) in tomato juice and successful cultivation of the organism in the laboratory. *Food Research*, **7**, 186 (1942).
20. Traisman, E., and Rice, C. R. Method for preserving pimiento. U. S. Patent 2,649,378 (1953).
21. Wessel, D. J., and Roberts, H. L. Processing studies on pimientos. *Southern Canner and Packer*, **10** (No. 4) 12 (1949).

The Control of Tyrophagus lintneri (Osb.) in Cured Hams[a]

W. L. BROWN, T. N. BLUMER, and B. B. FULTON
North Carolina State College, Raleigh, N. C.

(Manuscript received December 5, 1953)

There is a tremendous loss in North Carolina from mite infestation of cured meats. During the last few years many cured hams have been examined in which the lean portions were completely destroyed by mites. Reports indicate that Virginia, South Carolina and Georgia have encountered the same problem. Specimens of mites taken at this station were identified[b] as *Tyrophagus lintneri* (Osb.) of the family of Acaridae.

The life history for all species of mites is not known, and no information could be found in the literature concerning this particular species. For information on the life cycle of other species of mites the studies by Eales *(1)*, Garman *(2)*, Metcalf and Flint *(3)*, and Shephard *(4)* are cited. In general, mites that infest food products are whitish in color and so small that they are barely discernible by the naked eye. When they are abundant, a quantity of fine brownish powder accumulates over and through the materials, and a characteristic musty, sweetish odor is given off by the infested products.

The objective of the present study was to find a suitable, non-toxic control for ham mites.

MATERIALS, METHODS AND RESULTS

Since the size of the mite made it difficult to set up controlled experiments to determine the exact number of mites destroyed by each treatment, and since the precise count was of less concern than the fact of infestation itself, the procedure used was to establish by means of a magnifying glass the presence of a sizeable population on any single ham under treatment. The number of mites on each of the hams selected appeared to be in the millions. In cases where such extremely large numbers are involved, the effect of a given treatment can be reported for practical purposes as a percentage of the initial population. Treatments for control have been evaluated in many tests conducted during the last few years. The most pertinent results are reported in this paper.

[a] Contribution from the Departments of Animal Industry and Entomology, North Carolina Agricultural Experiment Station. Published with the approval of the Director as Paper No. 526 of the Journal Series.

[b] By Dr. E. W. Baker, Division of Insect Detection and Identification, U. S. Department of Agriculture.

Effect of insecticides. Several insecticides were used with very little success. These were: (a) 2 to 5% D.D.T., used as a spray; (b) pyrethrum, used, as recommended by the manufacturers, as an aerosol; and (c) Aramite, used as a spray inside the storage room after fumigation at the rate of 1 pound to 50 gallons of water.

The ham storage room was constructed so that methyl bromide could be used as a fumigant. Methyl bromide, used at the rate of 2 pounds per 1000 cubic feet, successfully destroyed the mite in the crawling stage. However, after 4 to 6 weeks the room became infested again, ascribable, presumably, to some resistant stage in the life cycle that permitted proliferation. Similar results were obtained by fumigation of commercial ham storage rooms with methyl bromide and hydrogen cyanide. Mites were controlled temporarily each time, but hams again became infested after varying lengths of time.

Effect of high and low temperatures. In one trial 4 hams were used to determine the effect of boiling water as a means of destroying mites and the eggs. Immediately after removal from the ham storage room the mite-infested hams were dipped in boiling water for the following lengths of time. Ham No. 1, 10 seconds; Ham No. 2, 30 seconds; Ham No. 3, 45 seconds, and Ham No. 4, 60 seconds.

To insure against any possible reinfestation the hams were placed in thick paper bags with the top of the bag tied tightly against a layer of cotton containing a miticide. The bagged hams were allowed to remain in storage for a sufficient length of time to give an increase in mite population. After this period each ham was examined carefully with a magnifying glass to determine if mites were present. Mites were found on all hams, but only in small numbers.

To study the effect of low temperature on the mite, 3 hams were placed in storage at 0° F. One ham was removed from storage each week. It was then hung at room temperature in a heavy paper bag. Examination of the hams at regular intervals revealed no living mites.

Effect of light. The effect of light on the mites was first noticed when an attempt was made to increase the number of mite-infested hams for experimental purposes. One heavily infested ham was removed from storage for use as a source of mite supply. The mites were transferred to 5 noninfested hams by placing a portion of the infested ham in contact with each noninfested ham. The hams were then placed in an open pasteboard box on the cement floor in a room with a large single window. The mites were observed crawling over all hams in a relatively short period of time. But after a period of 5 days a thorough examination revealed no mite activity. This procedure was repeated with 5 additional hams removed from storage where they had become infested by natural means. These hams were observed periodically and the results recorded in Table 1.

TABLE 1
Mite activity at high temperature with light

Time Elapsed (hours)	Movement of Mites	Temp. ° F.
1	Active	82
3	Active (reduced number)	87
5	Active (reduced number)	89
7	Active (reduced about 50%)	92
22	No living mites observed	93
46	No living mites observed	94

To determine if there would be any change in activity at a lower temperature the 5 hams were moved to a room that ranged in temperature from 64° to 82° F. These hams were placed in the room in a manner to allow daylight to come in contact with all parts of the ham. No living mites were observed after checking each ham daily for a week.

The effect of daylight on mite activity was determined by hanging one mite infested ham approximately 6 feet from a window. The light intensity, measured with a photographic light meter near the surface of the ham, was 180 foot candles. The observations made are shown in Table 2.

In order to study the effect of artificial light on the mite, 2 mite-infested hams were centered between two 200-watt bulbs. The surface of one ham was exposed to a light intensity of approximately 1600 foot candles. The other was wrapped in aluminum foil to use as a control. Results are shown in Table 3.

The control ham was unwrapped at the end of 72 hours and no apparent reduction in mite population had occurred.

To determine the practical use of these findings, four 150-watt light bulbs were placed in a ham storage box containing approximately 75 mite infested hams. The mite population was greatly reduced during the first week. At the end of 23 days no activity was observed. The light intensity in this box varied from 0.4 foot candles in the darkest corner to a reading in excess of 1600 foot candles near the source of light. The light killed and repelled the mites and prevented them from becoming established on new hams. Although it is doubtful that this treatment would eliminate the mites in all pockets located deep inside the meat, it might be useful in combination with other control measures, such as low temperature storage, to prevent the spread of infestations.

TABLE 2
Mite activity in daylight

Time Elapsed (hours)	Mite Activity
1	Very active
2	Moderately active
4	Slight reduction in number
6	Reduced in number about 25%
24	Reduced in number about 50%
48	Reduced in number about 85%
72	Small number of mites observed
120	Very few mites observed

TABLE 3
Mite activity with artificial light

Time Elapsed (hours)	Mite Activity
1	Reduced in number about 50%
2	Reduced in number about 75%
4	Limited number of mites observed
6	Few mites observed
24	Less than 10 mites moving
48	Two mites moving
72	No mites moving

SUMMARY

Various treatments were tested in an attempt to find a suitable, non-toxic control for ham mites. The insecticides tested were found to be unsuccessful as a means of permanent control. Fumigation with methyl bromide successfully destroyed the crawling stage of the mite. However, there are obvious disadvantages to the use of a poisonous gas. The use of low temperature or storage at 0° F. for a period of 1 week eliminated the mites.

This work indicates that light, either artificial or natural, is useful in the control of the destructive mite *(Tyrophagus lintneri Osb.)* on cured meats. The rate and number of mites killed will be influenced by temperature, moisture and light intensity.

Acknowledgment

The authors wish to express sincere appreciation to Dr. E. W. Baker, U. S. Department of Agriculture, for identification of the mite discussed in this paper.

LITERATURE CITED

1. Eales, N. B. Life history and economy of the cheese mites. *Ann. Applied Biol.*, 4, 25-28 (1918).
2. Garman, P. A. A study of the bulb mite *(Rhizoglyphus hyacinthi* Banks). *Conn. Bull. 402*, 855-904 (1937).
3. Metcalf and Flint. *Destructive and Useful Insects.* 2nd ed., 1939, New York and London.
4. Shepherd, H. H. Laboratory procedures in the study of chemical control of insects. *Publ. of Amer. Assoc. Adv. of Science*, Washington, D. C., 20, 48 (1943).

Hygroscopic Equilibria of Whole-Grain Edible Forms of Rice

D. F. HOUSTON AND E. B. KESTER
Western Utilization Research Branch,[a] Albany, California

(Manuscript received December 14, 1953)

Equilibrium moisture values have been determined for parboiled and quick-cooking rices at 77° F. (25° C.) and for parboiled rice at 100° F. (37.8° C.) at atmospheric relative humidities of 11 to 93%. Comparisons are made with reported values for brown and white rice at 77° F. and quick-cooking rice at 100° F.

Hysteresis effects are greater on quick-cooking and parboiled rices (processed with moist heat) than on raw white and brown rices. Up to about 80% R.H. at 77° F., the moisture equilibria of quick-cooking rice are lower than those of other rices. In the same R.H. range, a temperature rise from 77° to 100° F. lowers the equilibrium moisture of parboiled and quick-cooking rices by 1 to 2%.

Moisture equilibrium data have been reported on rough rice *(6)*, brown rice *(3)*, and white milled rice *(6)*, but only limited information is available on parboiled and quick-cooking *(2)* forms of rice. This investigation was performed to obtain data on these latter rice products and compare them with corresponding figures for white and brown rice.

Most rice is eaten as white rice. There are, however, three other forms which are consumed in appreciable amounts aside from frozen or canned rice and prepared breakfast cereals. Brown or husked rice (rice from which the husk has been removed but which retains the bran) is preferred by some people for its higher vitamin and mineral content and its distinctive flavor. Parboiled rice has been soaked, steamed, and dried in the husk before milling to correspond to white rice. It has a light amber color, a characteristic flavor, and a higher vitamin and mineral content than white rice. Originally developed in Southeast Asia, parboiled rice is now prepared by modern processes at three mills in this country and is finding increasing consumer acceptance. Several forms of quick-cooking dry rice have appeared on the domestic market in recent years, and are widely sold. They are generally made by soaking and partially cooking the rice, then drying or heating it in a manner which leaves it porous or permeable. The treatments may remove considerable amounts of soluble constituents and yield a very white and bland product.

The moisture contents of all these forms of rice, which bear direct relations to the relative humidity of the surrounding atmosphere, are important among the factors governing keeping quality, either in bulk or in package. Package design must include consideration of the moisture characteristics of the product in relation to expected storage conditions. Molds and other microorganisms may attack the rice at atmospheric relative humidities of 75% or more *(7)*. Hence, moisture contents should be kept lower than those found in this humidity range. Moreover, moisture plays an important part in governing other reactions that may occur during storage, such as increase in free acids and rancidity in the oil *(3, 4)* and in development of discoloration.

[a] Agricultural Research Service, U. S. Department of Agriculture.

Moisture characteristics of parboiled and quick-cooking rices may vary somewhat from process to process, or even between lots from the same process. Commercially suitable products in each class will, however, be likely to show rather similar behavior. The parboiled and quick-cooking rices reported on were commercial products considered representative of their respective classes.

Values are presented for the equilibrium moisture contents of the four types of rice over the range of relative humidities from 11 to 93%. Results obtained in this laboratory have been compared with previously published results in order to give a comparative set of moisture-humidity relations for edible whole-grain types of rice.

MATERIALS AND METHODS

Descriptions of the rice samples on which data are reported are given in Table 1. All moisture values in the present investigation were determined, on material ground to pass 20-mesh, by drying 5 hours at 100° C. according to the A.O.A.C. vacuum-oven method *(1)*, and all moistures are reported on the wet basis.

TABLE 1

Sample Descriptions

Type of rice	Variety	Harvest year	Original moisture %
Brown *(3)*	Caloro	1950	14.8
White	Calrose	1951	12.3
White *(6)*	Rexoro	1947 (?)	15.8
Parboiled	Rexoro	1950	13.1
Quick-cooking	long-grain	market purchase	9.5
Quick-cooking *(2)*	long-grain	not reported	....

The method of establishing moisture equilibria in this work was that previously reported *(3)*. Briefly, the whole-kernel sample was supported in a wire basket over a saturated salt solution in an apparatus (Figure 1) which allowed weighings without removal of the sample from the conditioning atmosphere. The relative humidities obtained by means of saturated salt solutions are recorded in Table 2. Samples were stored in constant-

TABLE 2

Relative humidities over saturated salt solutions at 25° C. (77° F.) and 37.8° C. (100° F.)[1]

Salt	Relative humidity, %	
	at 77° F.	at 100° F.
Lithium chloride	11.1	11.1
Potassium acetate	22.5	20.4
Magnesium chloride hexahydrate	32.5	31.9
Potassium carbonate	43.7	43.4
Sodium dichromate dihydrate	53.3	50.0
Sodium nitrite	64.4	61.8
Sodium chloride	75.4	75.1
Potassium chloride	84.3[3]	82.7[3]
Ammonium dihydrogen phosphate	92.5	91.1

[1] Taken from data of Wink and Sears *(9)* except for potassium chloride.
[2] Value of Stokes and Robinson *(8)*.
[3] Calculated from data in International Critcal Tables *(5)*.

temperature rooms at 77° and 100° F. (25° and 37.8° C.), and weighings were made in these rooms. Samples were weighed periodically until constant weight was reached, or until changes corresponded to less than 0.05% moisture in a week. Equilibrium moisture contents were calculated from the original moisture and the weight changes. Values obtained from triplicate determinations agreed to within ±0.01% moisture.

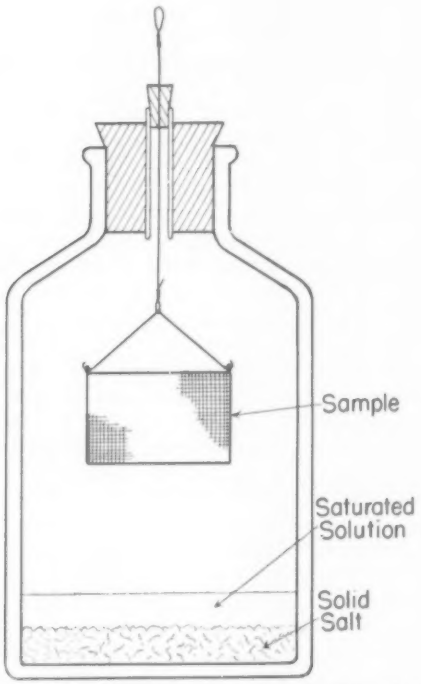


Figure 1. Apparatus used in determination of moisture equilibria.

RESULTS AND DISCUSSION

The moisture contents at 10% intervals of relative humidity, determined from the curves for the several rices, are collected in Table 3. They include values for all four rices at 77° F., and for parboiled and quick-cooking rice at 100° F. In addition, equilibrium values for Calrose white rice at 77° F. obtained at 22.5, 53.3, and 75.4% relative humidity were 8.7, 12.8, and 15.5% moisture. These correspond with 7.7, 12.4, and 15.6% moisture found by Karon and Adams *(6)* at the same humidities for naturally dried Rexoro rice.

There is relatively little difference between brown and white rice equilibria according to the results of the present investigations. Both rices, however, show slightly higher moisture contents at low R. H. than does the white rice measured by Karon and Adams *(6)*.

Parboiled and quick-cooking rice differ from the others in that they have been subjected to moist heat and their starch has been at least partially gelatinized. As a result their moisture-humidity relations may be expected to differ from those of brown or white rice.

Parboiled rice equilibria at 77° F. are almost identical with those of brown rice below about 60% R. H., which point corresponds approximately with the original moisture content of the parboiled sample. The values fall as much as 1% below those for white or brown rice in the R. H. range of 60 to 90%. Here the parboiled rice equilibria are approached from the dry side, and a marked effect of hysteresis is shown.

The quick-cooking rice has been subjected to partial cooking, copious washing, and rigorous drying. The removal of soluble matter in this process is probably the cause of the lower moisture at 77° F. when compared with the other forms of rice examined. The moisture-humidity curve for the quick-cooking rice shows a sag between 40 and 85% R. H., corresponding to hysteresis effects above the original 9.5% moisture content (about 37% R. H.). The effect is greater than that previously found *(3)* with brown rice, and may result in as much as 2% difference in moisture content at a single relative humidity when equilibrium is approached in one case from a drier condition and in the other from a wetter one. This is shown in Table 4.

At 100° F., moisture equilibria of parboiled rice are about 1% lower than those at 77° F. for the same humidities up to about 70% R. H. Above this point the differences diminish and disappear at about 90% R. H. Correspondingly, moisture equilibria for a quick-cooking rice at 100° F. are about 1.5 to 2% lower than those presently found at 77° F. in the range up to 80% R. H.

Perhaps the most interesting point concerning changes in moisture equilibria with temperature change is the effect of a temperature rise on a packaged rice with a specified moisture content. For instance, parboiled rice with 14.0% moisture is in equilibrium with air of about 68% R. H. at 77° F. If the temperature is raised to 100° F. (as in a hot storeroom), the moisture present in the rice would soon bring the interseed atmosphere up to 76% relative humidity. A similar temperature rise for quick-cooking rice with 13.0% moisture would change the equilibrium relative humidity of the air from 70 to 77%. As growth of microorganisms becomes an important factor in storage deterioration at relative humidities upwards from about 75%, it is evident that temperature rise alone has decreased the storage stability from this standpoint. This effect is in

TABLE 3

Comparison of equilibrium moisture contents of edible whole-grain rices at various relative humidities

Type of rice	Temp. ° F.	Orig. H_2O %	Percent Relative Humidity of Atmosphere								
			10	20	30	40	50	60	70	80	90
Parboiled	100	12.7	4.9	7.0	8.4	9.8	11.1	12.3	13.3	14.8	19.1
Parboiled	77	13.1	5.9	8.0	9.5	10.9	12.2	13.3	14.1	15.2	19.1
Brown *(3)*	77	14.8	6.2	8.0	9.5	10.9	12.3	13.5	14.8	16.2	19.1
White *(6)*	77	15.8	5.2	7.6	9.2	10.5	12.0	13.4	14.8	16.4	18.8
Quick-cooking	77	9.5	5.5	7.4	8.9	9.7	10.5	11.5	13.1	15.4	20.1
Quick-cooking *(2)*	100	....	3.7	5.5	7.0	8.2	9.2	10.3	11.7	13.6	....

TABLE 4

Hysteresis effect on moisture equilibria of a quick-cooking rice

Equilibrium relative humidity %	Equilibrium moisture	
	From drier condition[1] %	From wetter condition[2] %
43.7	9.9	10.3
53.3	10.8	12.3
64.4	12.1	14.3

[1] Rice had original moisture content of 9.5%.

[2] Rice had been brought to equilibrium at relative humidities 20 to 25% above those for final equilibrium; e.g., the 43.7% R. H. sample had previously been equilibrated at 64.4% R. H. (12.1% H_2O).

addition to any increased susceptibility towards rancidity development or other changes. The value may, therefore, be seen of storing edible rice with moisture content low enough to avoid trouble from high storage temperatures.

Acknowledgment

We wish to thank R. L. Roberts for assisting with some of the measurements, and Mrs. N. Floy Bracelin for preparing the illustration.

LITERATURE CITED

1. Association of Official Agricultural Chemists. Official Methods of Analysis, 7th Ed. A. O. A. C., Washington, D. C. (1950).
2. Elder, L. W. Functional package design. *Chem. and Eng. News*, **27**, 2682 (1949), and personal communication.
3. Houston, D. F. Hygroscopic equilibrium of brown rice. *Cereal Chem.*, **29**, 71 (1952).
4. Hunter, I. R., Houston, D. F., and Kester, E. B. Development of free fatty acids during storage of brown (husked) rice. *Cereal Chem.*, **28**, 232 (1951).
5. *International Critical Tables.* Vol. III, 1926, p. 373, McGraw-Hill Book Company, New York, N. Y.
6. Karon, M. L., and Adams, Maybelle E. Hygroscopic equilibrium of rice and rice fractions. *Cereal Chem.*, **26**, 1 (1949).
7. Milner, M. Biological factors in damp grain deterioration. *Food Technol.*, **5**, 25 (1951).
8. Stokes, R. H., and Robinson, R. A. Standard solutions for humidity control at 25° C. *Ind. Eng. Chem.*, **41**, 2013 (1949).
9. Wink, W. A., and Sears, G. R. Instrumentation studies. LVII. Equilibrium relative humidities above saturated salt solutions at various temperatures. *Trans. Am. Pulp Paper Inst.*, **33**, 96A (1950).

Notes and Letters

Approach to the Panel Studies of Foods and the Need for Standardization[a]

Every year members of the Institute of Food Technologists hear and read a larger number of papers on the panel evaluation of food products. Greatly accelerated interest in any subject often leads to a correspondingly rapid loss of interest. Since it is generally recognized that panels fill a long-felt need for precise measurement of food quality which cannot be met by other approaches, it follows then that food technologists should make certain now that the panel is more than a transient part of their basic working procedure. We should build the science of precise food evaluation into a permanent, universally accepted status above the questionable value of a passing fad.

One conspicuous need is for standardization. No test procedure becomes an integral part of any technology until it has demonstrated its value according to standard scientific criteria. Typically, also, the method must meet these criteria no matter where they happen to be applied. In other words, rigorous adherence to stated procedures should produce essentially the same results no matter who administers them. Panels then must fill all the requirements of standardization for specific measurement applications.

We do not intend to argue that we are as yet ready for total standardization of techniques, but we must soon agree on philosophy and direction, in order that agreement can be reached. Following the pattern of other fields of industry and science, we must agree on the type of measures, the units to be employed, the nomenclature, and the policies of interpretation involved. We must recognize that our advance is not yet unified and, even when it has been, it may not be defensible. In the opinion of some, we have just reached the state that medicine had reached during the bloodletting era. It may well be that the new tool is used too frequently and with too little caution. Not many centuries ago most every barber was a doctor and, not unlike the ancient barber physicians who employed leeches for the cure of almost any malady, so now do food technologists turn hastily to panels as a panacea.

Present status. At present, despite the efforts of the agencies and committees concerned, there are almost as many different panel techniques for measuring product quality as there are published reports of them.

An analysis of the last 30 issues of the journal of the Institute of Food Technologists reveals no less than 60 studies directly concerned with the problem of food flavor, appearance, and general acceptability. There is a strong tendency in the majority of the reports to omit the description of some of the most important parts of the experimental procedure. Typically, each article treating the evaluation of quality begins with a brief but adequate history, proceeds to state the problem, and then in the statements under test, begins to gather steam. For example, if the problem is concerned with beef quality, great care is taken to select cattle out of the same herd, matched for size, weight, color, and horn curva-

[a] Presented at the Annual Meeting of the Institute of Food Technology, Boston, Mass., June, 1953.

ture. The cattle are then very uniformly butchered and refrigerated, after which a flavor testing panel, of a convenient size and unspecified ability, is "selected" and any one of a variety of tests is conducted. The selection of the panel and specific method of test is treated with far less interest than is the cattle selection, often occupying no more than three lines in the report. Little more than passing comments are directed at the test environment, and most seriously in a study recording human reactions, the instructions to the judges are only rarely reported. The report then moves briskly ahead and a wealth of statistical data is presented and analyzed. All efforts so far have been directed at acquiring some data for interpretation, for this seems to be the real element of the typical investigator.

What has happened in the majority of the studies reported to the IFT? Food technologists apparently have developed a fascination for the *genus statistico*, and have forgotten the *genus homo*. As a result, few words and little interest are accorded the most important test variables of all. What is the test room like—its temperature, its humidity, its source of ventilation? Who are the observers? Are they truly representative? Are they trained? Are they selected? And if so, are they too sophisticated or too naive with regard to the problem at hand?

What about the test material—is it unnecessarily complex or in a form representative of its most frequent eventual use?

This perhaps should be expected for the reason that it is necessary for chemists, engineers, psychologists, bakers, home economists and representatives of other fields to supervise panel tests. They all meet on the common ground of mathematics. Surprisingly enough, however, when they leave their more familiar disciplines to measure quality, many forget their basic laboratory training and permit the free play of gross differences in those conditions which will affect their determinations. Even more seriously, they sometimes are guilty of employing loose logic in their interpretations of results. Again, it is alarming to note that after spending months in growing, procuring, or preparing the sample materials, someone rushes around to choose the panel in the morning and complete 500 observations with 10 people that same afternoon.

Nomenclature. With two technologists relatively well acquainted, communication is straightforward enough, until one of them begins with "why" type questions. Then there is no refuge for the individual being questioned. He cannot yet refer to IFT, ASTM, or ASA specifications. It is somewhat amusing that we do not agree on a name for the measurements we must attempt to standardize. Are they: organoleptics, taste-testing, flavor panels, psychometrics, acceptability, quality assurance, consumer testing, sensory panel testing, or subjective testing? At the United States Testing Company the term *Psychometrics* was selected as the most inclusive expression descriptive of the accepted methods employed in the evaluation of consumer products of all kinds. This term connotes measurement of human sensory responses of many different types, and is not restricted to the flavor, texture, or taste of the material. Psychometrics also includes the well known psychophysical methods which were developed in the last century and are still in use whenever it is possible to scale the stimulus materials according to some physical continuum. In addition, it covers the type of investigation in which no specific sensory system is involved. For example, in studies of instructions, new operations, or new concepts or ideas, and even in pleasantness reactions, the sensory system is incidental to the judgment.

Another term might be equally satisfactory as long as it is remembered that in panel analysis, the panel consists of complex human beings who can be misled or influenced by the smallest changes in the test situation. It must be remembered that the physical variables such as illumination, temperature, size of sample, interval between samples, and color are important only when they affect the judgment. The psychological influences (instructions, distractions, appearance, experience, sensitivity) must all be known and controlled, for the slightest cue may disrupt the most perfect physical controls. Psychologically, then, any factors capable of influencing judgment are of primary importance, no matter whether a psychologist or a chemical engineer is conducting the study.

Observers. With the general types of study, the need for uniformity of approach is less frequently mentioned than it is with the great observer problem. All evidence shows that we have a long way to go before we formulate guiding principles.

The selection of prospective panel members definitely has not reached any high degree of precision. Little is known about the relative importance of such factors as sex, age, health, motivation, sensitivity, and intelligence. One recent study, as yet unpublished, shows that even with the use of the material to be studied in screening prospective panel members, pre-tests of sensitivity are very disappointing. They do not predict future performance of panel members. In other words, when threshold tests of sensitivity to slight differences in milk are completed and all members are allowed to serve regardless of their ratings in the screening tests, the groups which would have been rejected on a screening basis perform as well as the originally more sensitive group. In typical instances, a month of constant training is required before an observer levels off at his peak performance.

It has been found that training of observers can be accomplished with a greater chance of success by administering a series of difference threshold studies, which at least succeed in acquainting the observer with the different qualities for which he is looking. Discrimination is enhanced by such experience.

As with the trained observer, the fundamental data are not available for grading the selection of the untrained or consumer-type participant. The influence of age, sex, economic status, occupation, and the life are unknown. In general, we believe that consumers are to a great extent interchangeable. Only those who fail to grasp the intent of the study are eliminated. As with the specialized group, we need first some intelligence concerning the number which can be expected to be atypical in a sample of consumers drawn at random.

Only then will we understand the implication of the problem of procuring a representative sample for the solution of a given problem.

Variable control. We have already discussed the need for and problems of the significant variables. Even when the investigator mentions in his published report that he has taken particular precautions, or states his method and instructions explicitly, should the variables be considered "in control"? From experience, we are aware that description may have been superior to method. In any event, the authors in such instances evidence knowledge of the importance of such controls.

We have pointed out that a panel of selected trained observers may be utilized in several ways. In our own laboratory, we maintain three panels of 25 observers each. One serves as a reliability check on the other two. The three panels participate at least once each day in the analytical and difference evaluations of a number of products always under precisely controlled environmental conditions. Sometimes these same panels are asked to serve as a portion of larger consumer panels in preference judgments. By this procedure, we reap additional benefits in that we accumulate considerable data on their patterns of likes and dislikes. A further advantage of this panel system is that all products are unknown to them and thus, they do not have strong preconceptions or inner knowledge about any of the test products. The presence of bias has led some companies to distrust their panels of supervisors, secretaries, and others who are familiar with each test objective.

The bias, along with physical exposure to the odor of the product daily and other reasons, has prompted at least one concern to conduct difference tests on consumers. This represents the ultimate in expensive nonstandardization. For the most part, the trained observers serve in concert to form an instrument of great sensitivity and precision in methods that a consumer may not readily understand. It is not to be expected that consumers in difference or preference studies would ever discriminate between samples which an adequate panel found to be identical. We know then that all conditions affecting a test are important, but no one has established optimal ranges for each. Again we need more data.

Conviction without proof. Additional case histories and descriptions of methods should be advanced so that the problems can be studied on an inter-laboratory basis. By working with interested cooperating companies, the Quartermaster Corps, the commercial laboratories, and the universities, a system should begin to emerge. Each of us "knows" empirically when an absolute judgment or rating scale should be used rather than a comparative test. We "know" that motivation is the most important single factor in the selection of optimum panels. We know that colored lights are inferior to twilight illumination for masking appearance, differences in foods. Still adequate tests are not yet extant.

We "know" that an observer performs best when he is not forced to divide his attention between say *difference* and *preference* at the same time.

We also believe that in the not too distant future prediction of preference as an indication of eating habits will be made from the reactions of an individual to five or six standard compounds. It is our conviction that we should begin now to program the effort toward such standardization.

Recommendations. We have described some of the typical approaches to panel testing of foods. It is apparent that *Food Technology* would gain by a standardization of nomenclature, methods, experimental designs and controls. The most conspicuous needs, as reflected in the published reports, are in the portions treating selection, training, and environment of the observers. Most articles, if pictured graphically, would be hour-glass in shape by way of emphasis. In other words, extensive attention is allotted to the treatment of the test samples at the outset and to the interpretation of results at the end. The crucial center portion is usually lean in that it omits the essential information on the measuring instrument used—the panel.

The first steps toward standardization have already been made on those portions dealing with the physical test materials and the mathematical analyses. Now we must have more complete indication of the variable affecting the behaviour of the panel. Then it will be possible to review the rationale. We believe that the spot lighting of the panel portion of the investigation will prompt more complete, better controlled, more sophisticated and therefore more uniform efforts for panel direction.

Then it will be possible to accelerate efforts for standardization which are already under way. Many investigators have developed excellent procedures, tested them exhaustively and proved their value, but they have not been published. If the published accounts accept the reorientation we suggest, and more accounts of methodological work are made available, the groundwork then will have been laid. After that, interlaboratory checks of the same materials can be made, and the relative merits of each procedure for a given type problem can be assessed. The principles of panel measurement then will emerge from the conjunctive efforts of the hard working individuals and committees who accept the responsibility.

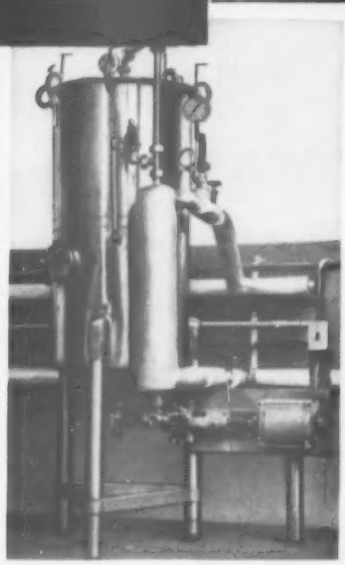
Once accomplished, the result will be improved, product quality maintained more uniformly, tested more economically, and communicated more effectively. The food industry is aware that the day of the expert is passing and the test panel has come into its own. It follows then that the selection and use of observer and consumer panels only require systematic analysis for most productive function in the standardized evaluation of food and beverage products.

DEAN FOSTER
United States Testing Company, Inc.

GENERAL REFERENCES

1. GUILFORD, J. P. *Psychometric Methods.* 1936, McGraw-Hill, New York, N. Y.
2. STEVENS, S. S. *Handbook of Experimental Psychology.* 1951, J. Wiley & Sons, New York, N. Y.
3. EDWARDS, A. L. *Experimental Design in Psychological Research.* 1950, Rhineharty Co.

These RESOURCES in SKILL and BASIC MATERIALS invite your investigation



TRUE FRUIT & IMITATION FLAVORS
UNIFORM · CONCENTRATED · STABLE

UNGERER & CO. NEW YORK

Ungerer & Co.

161 Avenue of the Americas, New York 13, N. Y.
plant and laboratories
Totowa, N. J.

CHICAGO · BOSTON · PHILADELPHIA · ST. LOUIS · LOS ANGELES · ATLANTA

DIRECTORY

The Institute of Food Technologists

President

BERTON S. CLARK
Research and Technical Department
American Can Co.
Maywood, Illinois

President-Elect

PHILIP K. BATES
Carnation Research Labs.
8015 Van Nuys Blvd.
Van Nuys, Calif.

Executive Secretary

CHARLES S. LAWRENCE
176 W. Adams Street
Chicago 3, Illinois

Assistant Executive Secretary

MARIAN A. GILCHRIST
176 W. Adams Street
Chicago 3, Illinois

Treasurer

AKSEL G. OLSEN
General Foods Corporation
1125 Hudson Street
Hoboken, New Jersey

Assistant Treasurer

ARTHUR N. PRATER
Gentry Division
Consolidated Grocers Corp.
837 N. Spring Street
Los Angeles 12, California

Executive Committee of the Council

B. S. Clark, B. E. Proctor, P. K. Bates, A. G. Olsen, C. O. Ball, G. E. Brissey, H. C. Diehl, G. F. Garnatz, A. C. Richardson.

Councilors-at-Large

Terms Expire 1954: H. C. Diehl, Geo. F. Garnatz, Louis B. Howard, Walter A. Maclinn, H. S. Mitchell.

Terms Expire 1955: C. O. Ball, E. J. Cameron, K. G. Dykstra, F. W. Fabian, M. A. Joslyn.

REGIONAL SECTION CHAIRMEN, SECRETARIES AND COUNCILORS

CHICAGO, No. 1: Chairman, S. F. Brockington. Secretary, Lloyd E. Slater, Food Engineering, 520 N. Michigan Blvd., Chicago 11, Ill. Councilors, S. F. Brockington, J. M. Jackson, R. F. Cohee, D. A. Huber, M. Ives, R. G. Tischer.

NORTHERN CALIFORNIA, No. 2: Chairman, H. S. Olcott. Secretary, Elise Hoffman, 425 Battery St., San Francisco, Calif. Councilors, H. T. Griswold, E. E. Jacobs, A. C. Richardson.

NORTHEAST, No. 3: Chairman, J. Donovan. Secretary, Lyle M. Richardson, 332 Franklin St., Wrentham, Mass. Councilors, M. E. Highlands, L. B. Sjostrom.

SOUTHERN CALIFORNIA, No. 4: Chairman, M. S. Dunn. Secretary, Gordon L. Merchant, Merck & Company, Inc., 1855 Industrial St., Los Angeles 21, Calif. Councilors, R. H. Higby, M. E. Powell, W. E. Baier.

ST. LOUIS, No. 5: Chairman, J. N. Demsey. Secretary, Barbara Hall, Anheuser-Busche, Inc., 721 Pestalozzi, St. Louis 18, Mo. Councilor, B. Miller.

NEW YORK, No. 6: Chairman, A. A. Schaal. Secretary, Eleanor M. Crozier, United Fruit Co., Pier No. 3 North River, New York 6, N. Y. Corres. Secretary, W. A. Maclinn, N. J. Agri. Exp. Sta., New Brunswick, N. J. Councilors: O. Skovholt, R. F. Light, C. N. Frey, F. C. Baselt, A. H. Johnson.

FLORIDA, No. 7: Chairman, R. W. Kilburn. Secretary, Donald J. O'Brien, American Can Co., Res. Div., P. O. Box 1732, Tampa, Fla. Councilor, W. R. Roy.

WESTERN NEW YORK, No. 8: Chairman, E. L. Sexton. Secretary, Catherine Personius, N. Y. S. College of Home Econ., Cornell Univ., Ithaca, N. Y. Councilor, W. S. Conway, Jr.

GREAT LAKES, No. 9: Chairman, Pauline Paul. Secretary, H. Clifford Scott, Owens-Illinois Glass Co., Packaging Research Div., Toledo, Ohio. Councilor, L. J. Minor.

PHILADELPHIA, No. 10: Chairman, R. A. Pouchain. Secretary, Edwin C. Dryden, Eastern Regional Research Lab., Philadelphia 18, Pa. Councilors, A. D. Bowers, J. P. Crimmins.

MARYLAND, No. 11: Chairman, A. M. Kaplan. Secretary, William J. Hart, Jr., John H. Dulany & Son, Inc., Fruitland, Md. Councilors, A. H. Warth, E. G. Heyl.

PUGET SOUND, No. 12: Chairman, G. Ivor Jones. Secretary, Kathryn L. Osterhaug, U. S. Fish & Wildlife Service, 2725 Montlake Blvd., Seattle 2, Wash. Councilor, C. W. Hurlbut.

AMES, No. 13: Chairman, Glen E. Cooper. Secretary, Frances Carlin, Foods & Nutrition Dept., Iowa State College, Ames, Iowa. Councilor, W. H. Montgomery.

MOHAWK VALLEY, No. 14: Chairman, M. Glickstein. Secretary, Carl W. Nordgren, Chr. Hansen's Laboratory, Inc., Little Falls, N. Y. Councilor, M. E. DeBenedictis.

OHIO VALLEY, No. 15: Chairman, A. R. Winter. Secretary, Mary E. Green, Schl. of Home Econ., Ohio State Univ., Columbus 10, Ohio. Councilor, N. H. Volle.

OREGON, No. 16: Chairman, H. Y. Yang. Secretary, Curtis J. Wilder, Food Technology Dept., Oregon State College, Corvallis, Ore. Councilor, P. R. Elliker.

DIXIE, No. 17: Chairman, C. D. Schiffman. Secretary, Carroll F. Neff, 193 Princeton Way, N. E., Atlanta 6, Georgia. Councilor, J. O. Mundt.

TEXAS, No. 18: Chairman, B. L. Golub. Secretary, Sara D. Groves, 4132 Tuam Street, Houston, Texas. Councilor, A. V. Moore.

AUSTRALIA NORTHERN, No. 19: Chairman, J. F. Kefford. Secretary, V. M. Lewis, 25 Byron St., Coogee, N. S. W., Australia. Councilor, J. R. Vickery.

INDIANA, No. 20: Chairman, V. R. Rupp. Secretary, Verna McCallum, 941 N. Meridian, Indianapolis 6, Ind. Councilor, N. W. Desrosier.

PITTSBURGH, No. 21: Chairman, G. W. Seagren. Secretary, Paul Somerville, H. J. Heinz Company, 1060 Progress St., Pittsburgh 30, Pa. Councilor, D. M. Gray.

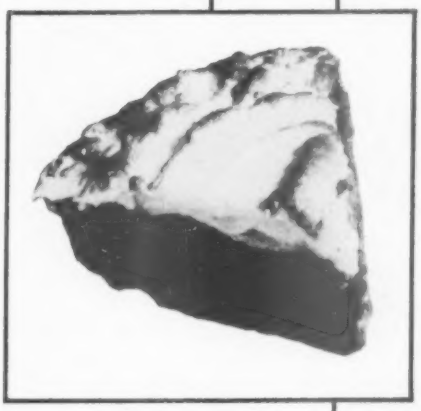
BRITISH COLUMBIA, No. 22: Chairman, P. A. Sunderland. Secretary, Wm. D. Sargent, 1512 Boundary Rd., Vancouver, B. C., Canada. Councilor, C. C. Strachan.

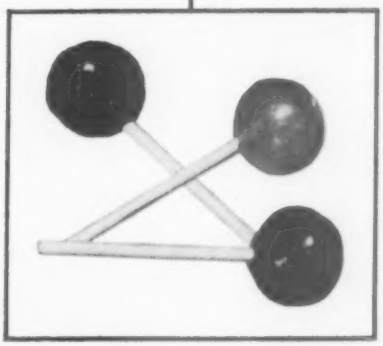
AUSTRALIA SOUTHERN, No. 23: Chairman, H. G. Jessep. Secretary, Marjorie K. Paxton, H. J. Heinz Co. Pty. Ltd., Bendigo St., Richmond, Vic., Australia. Councilor, G. F. Midwood.

MEMBERSHIP

Write to nearest regional secretary, if within an area covered by a regional section, or to the Executive Secretary of the Institute for an application form and information regarding qualifications and classifications.

THEY'RE ONLY AS GOOD AS THEIR FLAVOR!





FOR THE GOOD OF YOUR PRODUCT CONSULT FRITZSCHE .... *A FIRST NAME IN FLAVORS SINCE 1871*

FRITZSCHE *Brothers, Inc.*

Established 1871

PORT AUTHORITY BUILDING, 76 NINTH AVENUE, NEW YORK 11, N. Y.

BRANCH OFFICES *and* °STOCKS: *Atlanta, Georgia, Boston, Massachusetts, °Chicago, Illinois, Cincinnati, Ohio, Cleveland, Ohio, °Los Angeles, California, Philadelphia, Pennsylvania, San Francisco, California, St. Louis, Missouri, °Toronto, Canada and °Mexico, D. F.* FACTORY: *Clifton, N. J.*

HOPE YOU'LL VISIT US IN BOOTHS 19-20
I.F.T. CONVENTION, LOS ANGELES

SERVING INDUSTRY . . . SERVING AMERICA
You are always close to Continental Can with its 78 plants in the United States, Canada and Cuba, 17 field research laboratories and 66 sales offices.

EAT AND BE HEALTHY

Doctors will tell you that the normal person can get all the proteins, minerals, vitamins and other nutrients he needs just by eating three nourishing meals a day.

The foods required for an adequate diet are available in convenient packaged form in any food store. Prepared under scientific control—often cooked in the sealed container in which they are sold—these foods are taste-appealing, safe, nourishing and economically priced.

All that is necessary is to make a reasonable selection from the store's shelves and freezer compartments. By "reasonable selection" is meant properly proportionate amounts from *all* the basic seven food groups, including fruits, vegetables, meats or fish, milk products, cereal foods and butter or margarine.

As a general rule, diets that stress any one food or that revolve around some unusual food, even when supplemented by pills and tonics, are advisable only when prescribed by the physician to meet some special health condition. Unless a person has a diet problem, the wisest thing for him to do is to go ahead and eat a properly balanced diet by selecting some food each day from each group of the "Basic Seven."

Good as packaged foods now are, processors are constantly seeking ways to make them even more nutritious. And, as part of our Tailor-Made Package Service, Continental scientists and engineers are aiding hundreds of food processors in this search. We are proud that while helping our customers to use our containers of metal, paper, foil and other materials, we are also helping to improve the diet of the nation.

(This advertisement originally appeared in full-color in TIME, BUSINESS WEEK and FORTUNE.)

CONTINENTAL CAN COMPANY

CONTINENTAL CAN BUILDING — 100 E. 42nd ST., NEW YORK 17, N. Y.

CONTINENTAL CAN COMPANY OF CANADA LIMITED, MONTREAL

Ask Us For Help

KLENZADE TECHNICAL RECOMMENDATIONS FOR YOUR IN-PLACE CLEANING PROBLEMS

KLENZADE

O-R SYSTEM FOR Recirculation Cleaning

O-R ORGANIC ACID CLEANER

Klenzade nation-wide pioneering research and development work bring you today's most advanced recirculation cleaning methods with the Klenzade O-R System and the miracle of "chelation." With this system you can be sure of physical, chemical and bacteriological cleanliness without corrosion or injury to metal surfaces. The O-R System begins with Klenzade O-R Organic Acid Cleaner for milkstone, lime, and soil dissolution followed by Klenzade O-R Alkaline Cleaner for complete clean-up.

O-R ALKALINE CLEANER

The use of these two special acid and alkaline cleaners produces a chemical "double!" an amazing series of reactions called "chelation." Soil, film, and baked-on deposits are completely removed. Water-borne minerals are sequestered and isolated from re-precipitating onto cleaned surfaces. Result: No flocking, streaking or film. For recirculation cleaning at its best, consult Klenzade.

Free Manual

"IN-PLACE CLEANING PROCEDURES WITH RECIRCULATION METHODS"

"There's A Klenzade Man Near You"

KLENZADE PRODUCTS, INC.

Branch Offices and Warehouses Throughout America

BELOIT, WISCONSIN

SELECTED ABSTRACTS

(Continued from page 28 preceding technical papers)

counts, urinalyses, pancreatic enzymes, gastrointestinal, radiographic studies, or quant. analyses of stools for fats and N were observed in the "normal" children.

The effect of emulsifying agents (Tween 60 and Span 60) on the gastro-intestinal tract.

STEIGMANN, F., GOLDBERG, E. M., AND SCHOOLMAN, H. M. *Am. J. Digest. Diseases, 20,* 380-4 (1953).

The gastro-intestinal studies by the methods described with Tween 60 and Span 60 point to the fact that these substances given in doses of 6 g. per day for 28 days have no significant effect on the physiologic activity of the gastro-intestinal tract as measured by changes in the gas pattern of the bowel, by gastric emptying time, by passage of barium through the gastro-intestinal tract, and by gallbladder visualization studies. These studies also indicate that neither Span 60 nor Tween 60 in the large doses studied produce any significant changes in gastric acidity or gastric motility.

Toxicity of quaternaries.

FINNEGAN, J. K., AND DIENNA, J. B. *Soap, Sanit. Chemicals, 30,* 147-53*, February, 1954.

The introduction of quaternary ammonium germicides, either willfully or accidentally to food products is unlawful but there is no hazard involved should such adulteration take place. It was indicated earlier in this report that less than 1 p.p.m. of quaternary could be recovered from glass tumblers sanitized with a 200 p.p.m. soln. of quaternary. It is doubtful that in normal plant practice more than this amt. could be picked up from plant equipment which had not been properly rinsed with fresh H_2O. The willful addn. of quaternary to food in substantial amts. would be readily detected because of taste problems. Various studies were made by workers in this field and it is the general consensus that the bitter and astringent taste of quaternaries is readily discernible in food products when as little as 10-20 p.p.m. are added.

Toxicity studies on hydroquinone.

CARLSON, A. J., AND BREWER, N. R. *Proc. Soc. Exptl. Biol. Med., 84,* 684-8 (1953).

Chronic toxicity expts. with hydroquinone were carried out in rats, dogs, and men at dose levels greatly exceeding those to be expected in hydroquinone where utilized commercially as a preservative in food fats. It was found that relatively tremendous quantities of the substance had to be ingested before demonstrable physiol. pathology occurred in the exptl. animals. Acute studies on rats revealed that the LD_{50} of fasted animals was approx. ⅓ that of feed controls. The relatively large amt. of hydroquinone that could be administered with impunity indicates that the compd. could be used safely as a food preservative.

ENGINEERING AND PLANT EQUIPMENT

Chemical engineering. Unit operations.

Ind. Eng. Chem., 46, 57-140, January, 1954.

The review covers the following unit operations: absorption and humidification, adsorption, centrifugation, crystn., high temp. distn., drying, evapn., liquid extn., filtration, flotation, fluid dynamics, ion exchange, leaching, materials handling, mixing, and size reduction. An extensive list of references follows each topic.

A review of progress in food plant instrumentation.

WALTER, L., AND MEYER, J. *Food in Canada, 14,* 14-20, January, 1954.

Process by process, the article reviews the most successful applications of automatic control instrumentation in food manfg. Subjects include: fat frying, canning, dairy processing, air conditioning, spray drying, chocolate tempering and process cycle control.

FOOD AND FOOD TECHNOLOGY

BAKING AND BAKERY PRODUCTS

Chemistry of leavening.

VAN WAZER, J. R., AND ARVAN, P. G. *Northwest. Miller,* 251, 3a-6a*, February 9, 1954.

(Continued on page 36)

FOR THE FIRST TIME

HIGH FIDELITY

IN

TRUE FRUIT FLAVORS

MERORY FULL AROMATIC

CHERRY

TRUE FRUIT FLAVOR CONCENTRATES

Patent Pending

Merory Full Aromatic True Fruit Flavor Concentrates **completely retain the fragrant freshness of the volatile aroma and the full flavor of the fruit as well as the brilliant intensity of the fresh fruit color.**

Merory Full Aromatic True Fruit Flavor Concentrates **are produced by new techniques and are completely free from cooked taste and caramelization.**

Merory Full Aromatic True Fruit Flavor Concentrates **are the ultimate in flavor production.**

For Flavor Test Compare With Fresh Fruit

Merory Full Aromatic True Fruit Flavors Concentrates of:

MORELLO CHERRY — MF. 903

DALMATIAN CHERRY — MF. 904

WILD CHERRY — MF. 905

are recommended for use in flavor compounds, canned or frozen juice concentrates, syrup, sherbet, ice cream, bakery and candy fillings. They produce an unsurpassed quality.

MERORY FLAVORS

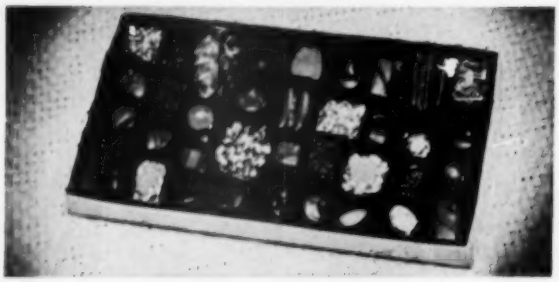
INCORPORATED

697 ROUTE 46, CLIFTON, N. J.

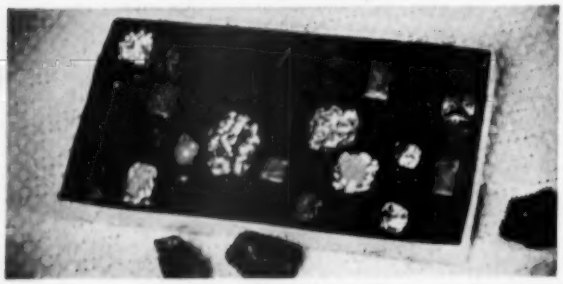
PRescott 7-4600

BOonton 8-3397

for flavors



that bring



them back

for more!

GIVAUDAN FLAVORS have helped many confectioners and ice cream manufacturers build new business and increase their repeat sales on the basis of truly distinctive taste appeal.

Givaudan is a *primary* source of supply—the world's largest producer of aromatics. Our flavor experts have developed a complete line of basic flavor materials, natural fruit and imitation flavors for every type of confectionery, ice cream, and other food products. They will gladly help you select the right flavor for your products . . . or cooperate with you in developing an individual flavor to meet your special needs.

Givaudan Flavors Inc.

330 West 42nd Street, New York 36, N. Y.

Branches: Philadelphia • Boston • Cincinnati • Detroit
Chicago • Seattle • Los Angeles • Toronto

SELECTED ABSTRACTS

(Continued from page 34)

A discussion of various types of leavening acids used in baking goods and curves showing the reaction rates of these acids. The effect of the various leavening acids on the plasticity of doughs is also reviewed.

Enzyme systems important in breadmaking.

JOHNSON, J. A., AND MILLER, B. S. *Wallerstein Labs. Communs., 16,* 105-15 (1953).

Two systems, amylases and proteases are involved in enzyme supplementation in baking. These systems may be provided from cereal, fungal or bacterial sources. The most notable difference among these sources concerns their thermostability. Bacterial amylase is most thermostable while the fungal amylase is least stable. Starch also exerts a protective action on bacterial amylase but does not affect the thermostability of cereal or fungal amylase.

COCOA PRODUCTS

The visual assessment of cured cacao.

DEWITT, K. W. *Trop. Agr. (Trinidad), 30,* 228-36 (1953).

Characteristics affecting value of fermented cacao are described and their detg. factors discussed. A scheme is suggested for the examn. of cacao for advisory purposes.

DEHYDRATED FOODS

Quality standards for dehydrated green vegetables.

BOYLE, F. P., HENING, J. C., AND WAGENKNECHT, A. C. *Farm. Res., 20,* 7, January, 1954.

Various methods were tried and standardized, values for browning, color, texture, dehydration capacity, and moisture content may be arbitrarily chosen which define levels of quality which must be attained if satisfactory dehydrated peas and snap beans are to be produced. There is no phys. or chem. method which can evaluate flavor. This must be analyzed by the taste panel test.

FLAVORS AND FLAVORING

Regulatory problems in the food flavoring field.

SALE, J. W. Assoc. Food and Drug Officials U. S. *Quart. Bull., 17,* 139-59 (1953).

An extensive compilation of the data available on natural and synthetic fruit flavors.

ODOR REMOVAL

More about chlorophyll reactions.

BARAIL, C. *Drug and Allied Inds., 40, 22,* January, 1954.

Nine out of ten people now believe chlorophyll a hoax whereas the reverse was true a year ago according to B. It is not effective for breath odors, control of menstrual, perspiration and body odor.

NUTS

Peanut roasting studies.

PICKETT, T. A., AND HOLLEY, K. T. Univ. of Georgia Agr. Expt. Sta. *Tech. Bull. No. 1,* 5-36 (1952); *Chem. Abstr., 47,* 12684a (1953).

The browning reaction accounted for the principal chem. changes occurring in peanuts during roasting. Sucrose was the principal carbohydrate involved, although crude fiber was involved to a slight extent. The high temps. merely accelerated reactions which proceed slowly at much lower temps. The proximity of the amino group to the carboxyl group in the amino acid influenced CO_2 evolution in the browning reaction, but such proximity did not influence the color development. Cellulosic substances reacted with the amino acids at 140° to produce CO_2 and brown colors. NH_3, H_2S, aldehydes diacetyl, and CO_2 were evolved during roasting.

PRESERVATION

Sorbic acid as a mold inhibitor.

SMITH, D. P., AND ROLLIN, J. N. *Modern Packaging, 27,* 139-41*, December, 1953.

Sorbic acid was selected as the most effective fungistatic agent presently available for use on cheese wrappers. It is

(Continued on page 38)

ASCORBIC ACID MERCK

Gives Your Products Point-of-Sale Appeal

If you market any of the food products listed below, note how MERCK ASCORBIC ACID can improve appearance, taste, or nutritional value. FRUIT JUICES can be fortified with Merck Ascorbic Acid to supply substantial amounts of Vitamin C at all times. FROZEN FRUITS protected against oxidation with Merck Ascorbic Acid look and taste better to flavor-conscious customers. MILK SUPPLEMENTS offer additional nutritional value when they include Merck Ascorbic Acid. FROZEN FISH, high in fat, get customer-appealing protection against rancidity and darkening when Merck Ascorbic Acid is the antioxidant.

Other Merck Products for the Food Industry:

Vitamin A Acetate	Niacin	Tartaric Acid
Riboflavin	Citric Acid	Sodium Benzoate
Thiamine	Sodium Citrate	Vitamin Mixtures

Research and Production for the Nation's Health

MERCK & CO., INC.
Manufacturing Chemists
RAHWAY, NEW JERSEY

© Merck & Co., Inc.

NEW
20-page booklet on
PRODUCT
CONDITIONING

Would your product be improved by better protection against hardening or drying out? Or by longer-lasting flexibility, softness, or controlled viscosity? Then this new booklet will be helpful to you. It discusses the technical aspects of product conditioning, and contains text, tables, and graphs that will help you select a product conditioning agent. Here are some of the subjects covered:

Choosing a product conditioning agent
Hygroscopicity
Nonvolatility (vapor pressure)
Viscosity
Solubility—solvent power
Compatibility
Chemical stability
Noncrystallinity
Nontoxicity
Taste
Product conditioning of foods and confections
Performance versus cost

For your free copy of this valuable new booklet, just write—Dept. FT, Glycerine Producers' Association, 295 Madison Avenue, New York 17, N. Y.

Nothing takes the place of Glycerine

SELECTED ABSTRACTS

(Continued from page 36)

metabolized in the same manner as caproic acid. Com. use is sanctioned by F. D. A.

ORGANIC CHEMISTRY

The mechanism of decarboxylation. Part VII. The decarboxylation of α-amino acids in benzaldehyde.

HAMMICK, D. L., ROE, A. M., WESTON, F. W., AND WHITING, K. D. E. *J. Chem. Soc.*, 3825-7 (1953).

A no. of amino acids in benzaldehyde at about 175° C. decarboxylate and yield 2-hydroxy-1:2-diphenylethylamine. The reaction takes place with anisladehyde but no other aromatic ketone or aldehyde.

PHYSICAL RESEARCH

New methods for determining the structure of peptides and proteins.

SCHLOGL, K. *Osterr. Chem.-Ztg., 54,* 8-16 (1953); *Brit. Abstr., AII,* 930 (1953).

A survey is given of recent methods employed to det. the constitution of peptides and proteins. General methods are first briefly described and discussed, and then special methods are treated, such as paper chromatography, and chem. processes based on the cleavage of the amino acids as N-substituted derivs. such as 2:4-dinitrophenyl-, *p*-iodophenylsulfonyl-, and N,N-dimethyl-amino-acids, and on their cleavage as phenylthiohydantoins, thiazolidones, mercaptothiazolidones, thiohydantoins, and amino-alcs. Finally, microbiol. methods are very briefly considered. (62 references)

A coaxial cylinder viscometer for the study of fluids under high velocity gradients.

MERRILL, E. W. *J. Colloid Sci., 9,* 7-19 (1954).

A coaxial cylinder viscometer is described for the abs. measurement of shearing stress vs. velocity gradient up to high values of gradient. Principal features of construction are: bottomless cylindrical shearing surfaces, very small annular clearance, rigid mech. alignment of the cylinders, and a pressure-feeding system. Several advantages are thereby achieved, over other cylindrical viscometers: (1) versatility in testing a wide range of viscous fluids, including gels; (2) measurement of shearing stress and corresponding velocity gradient as essentially point values; (3) variability of velocity gradient up to high values; (4) good control of fluid temps.; and (5) ease of introduction of fluids for test. Typical exptl. results are presented.

STATISTICS

Experiments with many factors.

BROWNLEE, K. A. *Chem. Eng. Progr., 49,* 617-21 (1953).

For expts. involving many factors, the factorial arrangement is many times more efficient than the simple (one variable at a time) expt. The main disadvantage is that the no. of runs required is often greater than is either practical or necessary. To fulfill the need for designs which will retain the efficiency aspect of the factorial expt. and the capability of detecting the presence of interactions, the technic of fractional replication is recommended. Several examples using some of the factors affecting cakes are given.

DR. L. E. CLIFCORN VOTED PRESIDENT-ELECT OF IFT

News of the 1954-55 IFT elections has just come in. The president-elect has been determined to be Dr. L. E. Clifcorn, Director, Fundamental Research, Research Division, Continental Can Company. Councilors-at-large are Drs. Berton S. Clark, J. Avery Dunn, Charles N. Frey, Lloyd A. Hall, and Harold S. Olcott. An account of the 1954-55 president, Philip K. Bates, and the new president-elect, L. E. Clifcorn, will appear in a subsequent issue of FOOD TECHNOLOGY.

Artificial GARLIC OIL

A Remarkable Reproduction . . .
At A Remarkably Low Cost . .

Florasynth LABORATORIES, INC.

CHICAGO 6 NEW YORK 62 LOS ANGELES 21
Cincinnati 2 • Detroit • • Dallas • Memphis • New Orleans 12
St. Louis 2 • San Francisco • San Bernardino
Florasynth Labs. (Canada Ltd.) • Montreal, Toronto, Vancouver, Winnipeg
Productos y Laboratorios Florasynth, S.A. Mexico 11, D.F.

PROTOVAN "F"

Imitation Vanilla Flavor

Imparts an aroma and taste similar to that of choice Bourbon Beans.

A Guide to a Better Beginning!

PURE VANILLAS

(Vanilla Veritas)

IN ALL CONCENTRATIONS

Our experience, research and careful temperature control has insured a superior brand of Pure Vanilla Concentrates.

MAPLEAROME

Imitation Maple Flavor Base

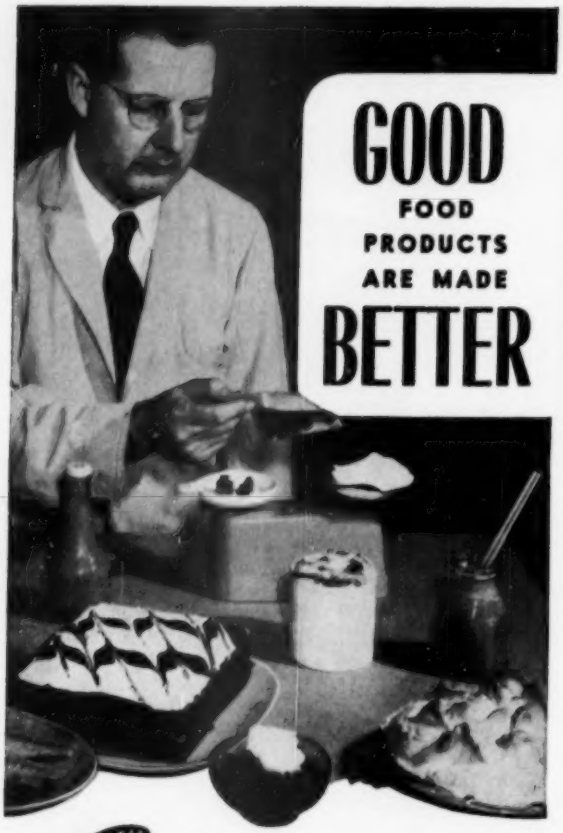
"The Essence of Good Taste"

. . . Produced mainly from materials of vegetable origin, this perfect Imitation Maple Flavor Base is a dependable reproduction of the aroma of Maple Sap . . .

Florasynth LABORATORIES, INC.

CHICAGO 6 • NEW YORK 62 • LOS ANGELES 21
Detroit 2 • Cincinnati 2 • Dallas
Memphis • New Orleans 12 • St. Louis 2
San Francisco 7 • San Bernardino
Florasynth Labs. (Canada) Ltd.
Montreal • Toronto • Vancouver • Winnipeg
Productos y Laboratorios Florasynth, S.A.

SEE FLORASYNTH FLAVOR PANORAMA—BOOTHS 41 & 42 AT THE I. F. T. MEETING



GOOD FOOD PRODUCTS ARE MADE BETTER

with SeaKem "COLLOIDS OUT OF THE SEA"*

Does your product have all the appetite and sales appeal it needs? . . . Can your manufacturing process be simplified or speeded up? . . . Has a really tough improvement problem got you ready to throw in the towel?

Then it's time right now to discover how SeaKem Stabilizers can help you.

The check list at right shows a few of the positive ways these remarkable colloids are improving dozens of items as widely varied as bakery product stabilizers, chocolate milk, dessert mixes, ice cream stabilizers, pet foods, pie fillings (fruit), puddings, sauces, sausages, and syrups.

Whatever your food product may be, if the function you are interested in is listed, it will pay you to get full information on SeaKem "Colloids Out of the Sea". For prompt, non-obligating recommendations, just write outlining your problem.

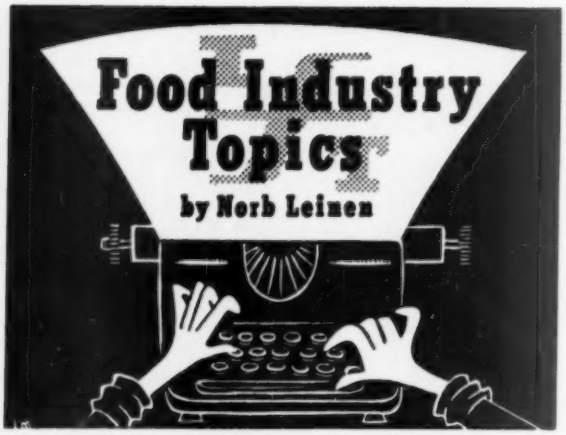
Here are a few of the functions being performed by SeaKem Stabilizers for an ever-growing list of food products:

- Binding
- Bodying
- Emulsifying
- Gelling
- Modifying
- Stabilizing
- Suspending
- Thickening
- Custardizing milk and products containing milk solids
- Improving mouth feel and flavor
- Increasing efficiency of component ingredients
- Modifying ice crystal growth
- Physical and anti-oxidant protection

* SeaKem is the registered trademark for the standardized, water-soluble, sea plant extractives manufactured by the Seaplant Chemical Corporation. Refined by rigidly controlled processes which insure dependable uniformity and purity, SeaKem "Colloids Out of the Sea" are light amber to colorless, free-flowing flaky powders. Available in a variety of types suitable for use in either dry or liquid applications, SeaKem Stabilizers have won acceptance on the basis of proven advantages with leading food manufacturers and processors.

Send for latest SeaKem Technical Bulletins

SEAPLANT CHEMICAL CORPORATION
43 David St., New Bedford, Massachusetts



. . . *in the public interest*

Science is bringing closer to commercial significance a **revolutionary technique for sterilizing foods, drugs, and medical supplies.** In place of extremes of heat or cold to kill or inactivate the microorganisms that cause spoilage and deterioration, X-rays and other forms of radiation may do many of the same jobs. Commenting on the development, Mr. Clyde Williams, president of Battelle Institute, Columbus, O., lists these advantages of radiation over conventional sterilization methods: (1) elimination of heat damage to heat-sensitive products, (2) possibility of sterilizing after product is completely packaged, and (3) applicability of radiation sterilization to an assembly-line procedure in place of the more costly conventional batch processing. Mr. Williams lists cheese, packaged meats, fruit juices, milk, and beverages among the heat-sensitive foods under study for this treatment. He cautions, however, that before the new sterilization method comes into widespread commercial use, such problems as changes in flavor, color, or texture, possible toxicity, and proper packaging must be overcome. None of these is considered an insurmountable difficulty.

◆ ◆ ◆

Establishment of Dairy Remembrance Fund, Inc.—an organization devoted to further the progress of the dairy industry—has been announced by Mr. Madison H. Lewis, president. The Fund, headquartered at 111 N. Canal St., Chicago, will serve as the central agency through which contributions may be made in honor of important milestones in the lives of dairy personnel. Through delegates from eight national and international dairy groups, it also will administer memorial trust funds which perpetuate great names within the dairy industry. Charter sponsors include American Dairy Science Assn., Dairy Industry Committee of the United States, Dairy Industries Society International, Dairy Industries Supply Assn., International Assn. of Ice Cream Manufacturers, Milk Industry Foundation, National Assn. of Retail Ice Cream Manufacturers, and National Dairy Council.

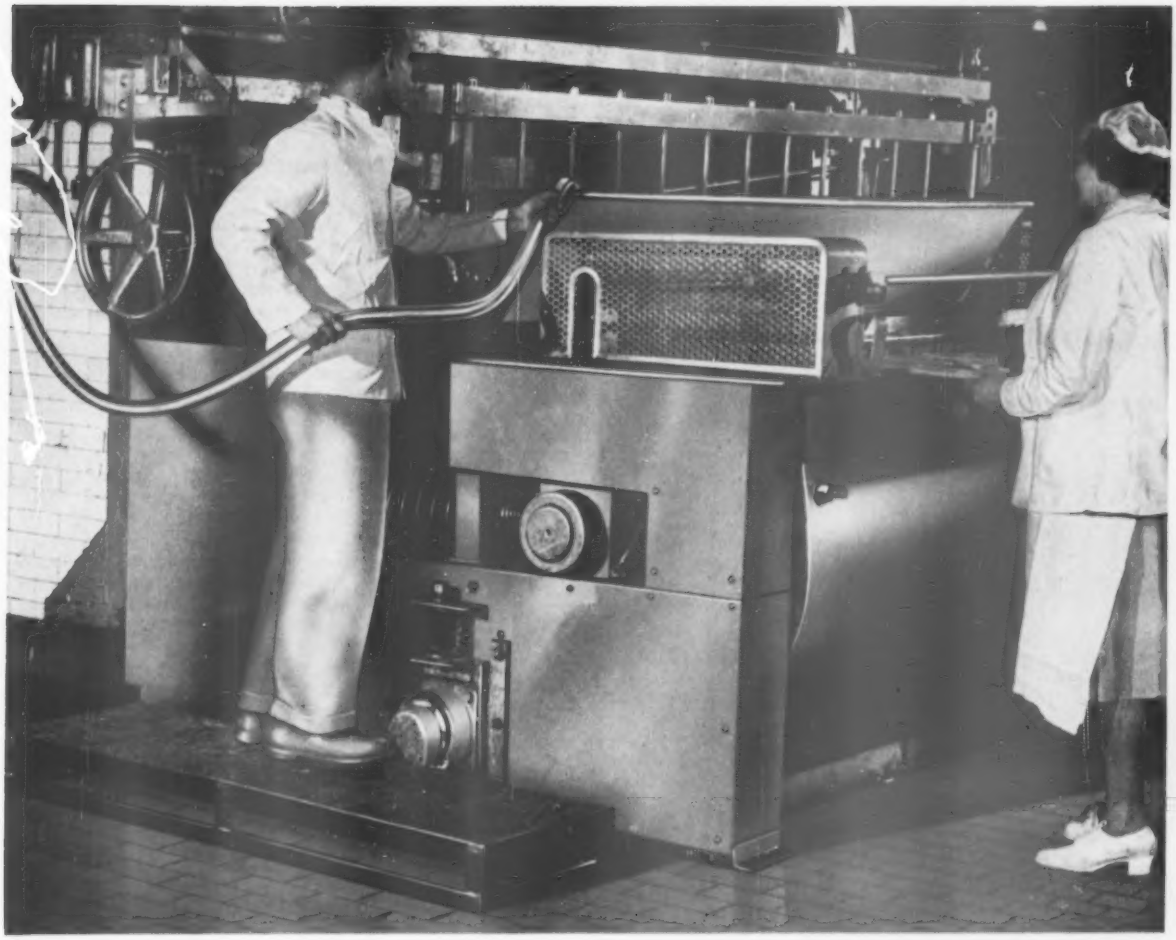
◆ ◆ ◆

In reviewing the advertising policy of Continental Can Company, Inc., Mr. Delbert Johnson, manager of advertising and sales promotion, told a recent regional canners' meeting that Continental's advertising is devoted to the canned foods themselves, and the ways in which the company is trying to help the food processors make them even more nutritious, appetizing, and generally available. According to Mr. Johnson, the ads do not sell brands or specific commodities. They are intended to educate and inform, and to stimulate thought about the tremendous role played by canned foods in our present-day economy. In this way, they provide a backdrop for specific brand and commodity advertising.

◆ ◆ ◆

Glycerine, already used successfully in preserving red blood cells, spermatozoa, and such living tissue as chick heart and rabbit ova at low temperatures, has extended its sphere to corneal grafts and testicular tissue. According to the Glycerine Producers' Assn., 295 Madison Ave., New York City, British doctors report that partial-thickness corneal grafts stored for

(Continued on page 42)



TYGON TUBING Safeguards Purity and Flavor at Horn and Hardart Co.

The world-famous "Automat" is noted for its pies. When you turn out thousands on thousands of pies daily automatic equipment is vitally important. But to Horn and Hardart Co. even more vital and important are the steps they take to safeguard purity and flavor.

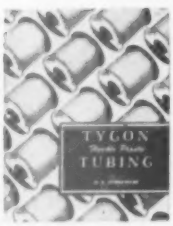
Take for example, the operation of filling pie shells. The pie filling (cherry, custard, pineapple — all the many flavors) is fed to the pie shells through crystal clear, 2" diameter B 44-3 TYGON plastic tubing.

Horn and Hardart Co., as do top-quality bakers everywhere, insist on Tygon because they *know* Tygon will neither absorb nor impart flavor, that no harmful ingredient can leach out to contaminate the filling. The plus advantages of Tygon: light weight, flexibility, clearness, easy cleaning, are important, too — but head-and-shoulders above everything else to food processors is Tygon's proven purity — guardian of their product and their reputation.

Don't take a chance on Tubing that's "just as good as Tygon." Ask for Tygon — insist on Tygon. It's *branded* for your protection.

Get the full story on TYGON TUBING

Write today for Tygon Tubing Bulletin. Its technical data may provide the answer you've been looking for. Address: U.S. Stoneware Co., Akron 9, Ohio.



PRODUCT OF

U.S. STONEWARE

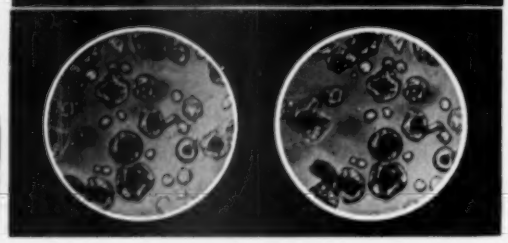
Plastics and Synthetics Division

178 D

P&S

POLVAROMAS

the PERFECT ANSWER to POWDERED FLAVORS



As illustrated in the above photomicrographs, Polvaromas are made through a special P & S process whereby a drop of flavor is entirely surrounded by a protective coating of edible, non-toxic vegetable material. With Polvaromas the flavor is not dried on the surface of a powder, but is locked within. This is proof of your gaining optimum flavor stability.

Here at last is the perfect flavor solution for all food products which are based on a dry composition.

Polvaromas are available in all popular flavors. We shall be happy to submit samples and further technical information for your approval.

USES FOR POLVAROMAS

SOFT DRINK POWDERS · GELATIN DESSERT POWDERS
PUDDING POWDERS · · · · · · · PIE FILLER MIXES
ICE CREAM MIXES · · · · · ICE & SHERBERT MIXES
DAIRY MILK DRINK POWDERS · · · · CHEWING GUM
CAKE & COOKIE MIXES · · · · · · · · ICING MIXES

See us at Booth 36, I. F. T. Convention

P&S POLAK and SCHWARZ

INCORPORATED

667 WASHINGTON ST., NEW YORK 14, N. Y.

CHICAGO • DETROIT • LOS ANGELES • MILWAUKEE • TORONTO

FOOD INDUSTRY TOPICS

(Continued from page 40)

nine months at minus 70° C. after immersion in 15% glycerine in Ringer saline, gave results comparable to those obtained with fresh material. The testicular tissue work involves storing tissue of the testes of young rats at low temperatures after soaking and freezing in 15% glycerine-saline solution, and then grafting in other animals. It is considered possible that these experiments may find application in transplanting endocrine and other tissue in man.

◆ ◆ ◆

An annual scholarship to Purdue University and another to the University of Notre Dame, to be awarded to male employees or to sons of employees, has been announced by American Wheelabrator & Equipment Corp., Mishawaka, Ind., manufacturer of blast cleaning machines and dust and fume control equipment. The scholarships, to be known as the Verne E. Minich Founder Scholarship and the Otto A. Pfaff Scholarships, to Purdue and Notre Dame respectively, provide for initial awards and for annual renewals thereafter in the sum of $650. Under the normal operation of the plan, beginning with the fourth year, eight students will be receiving scholarship benefits each year.

◆ ◆ ◆

High food sales reveal a **healthy purchasing power** that is a breeding ground for greater production and prosperity, Mr. F. B. Newcomb, Central Division sales manager for American Can Company, Chicago, recently told the Indiana Canners Association, "Today's food picture is very bright," said Mr. Newcomb. "Sales are higher than a year ago. We have returned to a free food market with plentiful supply in practically all items. These conditions, together with increased merchandising in the nation's food stores of a growing list of non-food items, are responsible for another healthy development in our industry —the return of strong competition." To help food canners everywhere meet this growing competition for consumer attention, Mr. Newcomb reported that Canco is embarking upon an extensive nationwide campaign to glamorize meals that can be prepared exclusively with canned foods.

◆ ◆ ◆

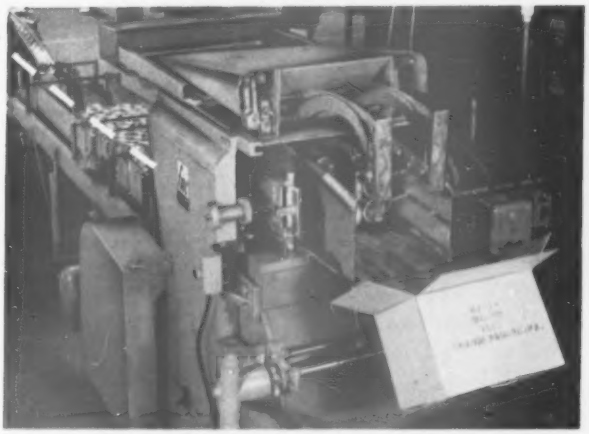
The first meeting of the newly formed Research and Development Advisory Committee on Soup and Gravy Bases at the Chicago Quartermaster Food and Container Institute considered improvements in soup and gravy bases in military subsistence. Present were, front row (from left): A. C. Edgar, Wilson & Co., Inc., Chicago; H. C. Needle, Universal Foods Corp., Chicago; T. C. Kmiociak, Quartermaster Institute, Chicago; K. T. Farrell, Quartermaster Institute, Chicago. Back row (from left): A. J. Harriman, Thomas J. Lipton, Inc., Hoboken, N. J.; G. F. Hansen-Sturm, Romanoff Caviar Co., New York City; F. W. Lonigan, The Nestle Co., White Plains, N. Y.; L. J. Minor, L. J. Minor Corp., Cleveland, O.; M. J. Sintov, Fearn Foods, Inc., Franklin Park, Ill.; and P. J. Kelley, Chicago Quartermaster Depot (legal officer). Research and development advisory groups are appointed by The Quartermaster General of the Army to provide voluntary advice and assistance to Quartermaster organizations concerned with research, development, production, and procurement problems.

◆ ◆ ◆

"High priced cocoa beans and peanuts are really testing candy manufacturers' ingenuity in order to give the American candy eaters the delicious, low cost confections they love so dearly," according to Mr. Philip P. Gott, president, National Confectioners' Assn., Chicago. Cocoa beans, Mr. Gott revealed, have risen 1000% in price per pound since 1941 while peanuts have gone up 320%. He noted that the candy industry had recommended to the U. S. Senate Committee on Agriculture and Forestry that peanuts be eliminated from the list of so-called "basic commodities" and the existing 90% price support for peanuts be ended January 1, 1955, and price support be provided on peanuts on a flexible scale at 75% to 90% of parity. With regard to cocoa, he reported that a thorough investigation by the Department of Commerce of the world cocoa bean situation has been asked by the NCA.

(Continued on page 44)

FROM HARVESTING TO CASING



FMC "Stalk to Storage" Corn Equipment Produces a Higher Yield—Delivers a Quality Pack

FMC has virtually grown up with – and in – the corn canning industry, helping it grow through continuous contributions of research and modern equipment development. Many of the industry's achievements – its supremely high standard of quality, its ability to produce in enormous volume – are the direct results of this long and fruitful partnership. Today you'll find FMC *specialized* "Stalk to Storage" corn equipment in every corn canning plant in the country, many of which are completely FMC equipped. And every year you'll find new and improved equipment that has been carefully designed to do specific jobs better, faster, for greater profit for you. Some of this equipment is shown or briefly described here. Your line should also include FMC Fillers, Sterilizers, Labelers and other Can Handling Equipment.

Above: **The FMC SWEET CORN HARVESTER** *gets all the corn in the field, produces corn for canners, freezers, even for the cob-corn market! It replaces a hand-picking crew of 10 and at greater yield.*

Below: **FMC's NON-SHOCK CASER** *automatically cases cans fast (up to 1,200 cases per hr.)—limited only by the speed of the operator It's gentle to cans, labels and products, cuts costs.*

OTHER FMC CORN HANDLING EQUIPMENT

- **FMC PEERLESS CORN WASHER** tumbles, scrubs and rubs ears together under high pressure water sprays. Removes all loose husks, silk and dirt.
- **FMC DOUBLE HUSKER** cleanly trims butts and strips husks at 2½ tons of corn an hour. Unequalled for efficiency!
- **FMC EAR CORN SILK BRUSHER,** with its brushes spinning at high speed, washes and scrubs every row of kernels of every ear, removing all silk. The larger handles output of 20 FMC Huskers; the smaller, that of 8 Huskers.
- **FMC UNIVERSAL ROTARY CORN CUTTER**—a key machine in any corn line for maximum recovery of kernels from the cob, for cream style or whole grain packs. Up to 120 ears per minute depending on operator's skill.
- **FMC SANITARY BLENDING MIXER** meets the most rigid sanitary specifications for mixing and heating cream style corn. All contact parts are of durable, easy to clean stainless. 3 sizes.

FOOD MACHINERY AND CHEMICAL CORPORATION

Canning Machinery Division

General Sales Offices:

WESTERN: SAN JOSE, CALIFORNIA **EASTERN:** HOOPESTON, ILLINOIS

Diamond Crystal Alberger Salt is

America's largest-selling High-Grade* salt

because...

the exclusive Diamond Crystal Alberger System produces:

Purity—99.95% Sodium Chloride.

Uniformity—maximum purity variation ±0.01% . . . screened to a standard for each food product.

Cleanliness—lowest insolubles of any commercial grade of salt.

Low heavy metals—averages less than 1.5 part per million of pro-oxidants copper or iron.

**The premium grade salt used by food processors.*

FOOD TECHNOLOGIST AT YOUR SERVICE

For free consultation on choice and application of the right salt for your food products—call, wire or write:

Technical Service Department
Diamond Crystal Salt Co.
St. Clair, Michigan
Phone—296

FOOD INDUSTRY TOPICS

(Continued from page 42)

. . . things new under the sun

Development of a **revolutionary type of infrared lamp** "of tremendous potential" for scores of heating, drying, baking, cooking, and other uses, was announced recently by General Electric's Lamp Division. A radical departure from any previous infrared lamp, the new quartz lamp comes in a compact tubular shape, slightly larger in diameter than a cigarette, and produces more than four times the energy concentration delivered by the popular 250-watt infrared bulb. Nevertheless, the lamp is reported to have unusual ability to withstand high temperatures and the shock of violent temperature changes. First application of the new lamp is expected to be in industrial radiant drying and baking ovens. Two sizes are being introduced, of 500 and 1000 watts, for use on circuit voltages of 115-125 and 230-250, respectively. Samples are now available to manufacturers wishing to develop equipment in which the quartz infrared lamp may be used. List prices are: 500-watt size, $7.00; 1000-watt size, $8.50. For further information write the General Electric Co., Nela Park, Cleveland 12, O.

◆ ◆ ◆

Increased production and greater efficiency at Ac'cent plants have resulted in a price cut according to officials of Amino Products Division of International Minerals and Chemical Corp., Chicago. The price of Ac'cent in lots of 20,000 pounds or more was reduced to $1.55 a pound from $1.70. Improvement of the Rossford, O., and San Jose, Calif., plants and the opening of a new 22,000 square foot warehouse and packaging plant in Chicago were cited as factors making possible the price reduction.

◆ ◆ ◆

A new type Zenith pulp press designed for added recovery of juice from pineapples has been added to the line of pulp presses manufactured from the food, chemical, and paper industries by Jackson and Church Co., Saginaw, Mich. Initial installation of the new screw-type presses is in the Hawaiian Pineapple Co. plant, Honolulu, Hawaii, where seven of them have been integrated into the firm's new system for processing Dole products.

◆ ◆ ◆

A paste detergent which features high quality and low cost is offered the food processing industry by Key Equipment Co., 217 E. Broadway, Milton-Freewater, Ore. The new flotation agent for pea cleaning, Key Froth Foaming Agent SIPON LS Special, was developed exclusively for Key by American Alcolac Corp., Baltimore, Md., and is used in the Key Froth Flotation Cleaner, a machine which removes foreign matter from peas, corn, lima beans, and other vegetables by a special flotation process. Mr. Francis Miller, Key production and sales manager, said that the new foaming agent is of the highest quality and has proven through research to clean more tons of produce per pound of detergent than any other material experimented with by Key and Alcolac, or previously used for this processing operation.

◆ ◆ ◆

A "coffee enhancer" designed to restore the original flavor and aroma lost by instant coffee during its manufacturing process has been developed by Dodge & Olcott, Inc., 180 Varick St., New York City. Coffee Enhancer No. 12132 was obtained by organic synthesis of flavor elements present in the original coffee bean, before processing into powdered form which removes much of the highly volatile flavor and aroma constituents. The product comes in liquid form, and when added to soluble coffees in minute quantities restores to the powdered material the important psychological effect of fresh coffee aroma—not only in the jar itself, but also in the beverage brewed from it. The enhancer may also be used to impart aroma to roasted coffee, although its most important application will be in the instant types. Still in pilot plant production, the product has already been favorably received by several well known coffee tasters. Price in 5-pound bottles—$7.00 per pound.

◆ ◆ ◆

The new Edfin portable slicer slices potatoes, pickles, cucumbers, beets, cabbage, onions, carrots, and other vegetables, as

(Continued on page 46)

Magic Crystals

Now End Flavor Fading In Your Processed Foods

With Zest,® 99+% Pure Monosodium Glutamate, Food Processors Make Foods More Flavorful Than Ever!

AMERICA'S LEADING FOOD PROCESSORS USE THESE STALEY PRODUCTS

Staley's 99+% Pure Monosodium Glutamate—pure, free-flowing crystals that intensify natural food flavors.

Corn Syrup—Sweetose Brand-high conversion sweetener for firmer texture, better flavor.

Corn Oil—A vegetable oil of highest quality for cooking and food processing.

Lecithin—An established emulsifier and antioxidant for the food industry.

No need to let heat, pressure and other processing conditions rob food of taste appeal. Zest magnifies the natural flavors without adding any flavor, color or aroma of its own. Whether your products are frozen, dehydrated or canned, Zest brings out all their natural goodness—puts them first on the consumer's shopping list.

A. E. STALEY MFG. CO., *Decatur, Ill.*

Zest

Staley's

Industries Served by Staley Products

BAKING • CONFECTIONERY • ICE CREAM • FOOD PROCESSING

FOOD INDUSTRY TOPICS

(Continued from page 44)

well as luncheon meats and cheeses to thicknesses of from 1/64" to 3/8". Several models will be available with interchangeable parts depending upon class of product to be sliced. The machine needs no installation, can be placed on a table, movable stand, or conveyor, is easy to clean and can be dismantled within a minute or two. Dimensions are 28½" high, 13" wide, and 22½" long. Total weight is approximately 50 pounds. Price, according to the manufacturer, Edfin Packaging Machinery Corp., 306 E. 123rd St., New York City 35, is about one-third the cost of comparable slicing machines.

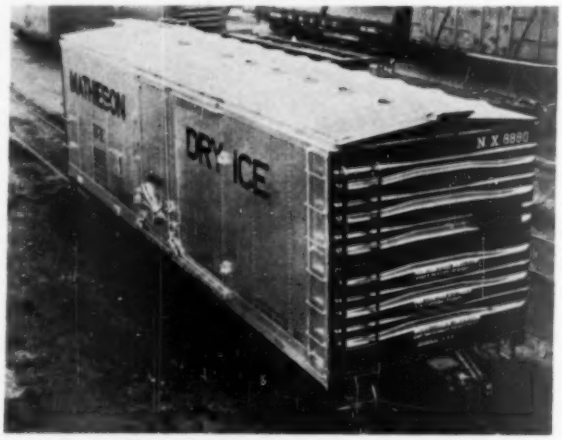
◆ ◆ ◆

Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J., announces a new chlorinator, the A-701, which features such improvements as dual orifice meter which automatically, or by the flip of a switch, allows feed ranges up to 100 to 1; corrosion resistant materials wherever good structural design permits; linear scale reading of chlorine flow rate; and automatic electric, hydraulic, air, or vacuum control. Maximum capacity of the A-701 is 1000 pounds per 24 hours.

◆ ◆ ◆

Strained meats packed in glass jars, entirely new in the baby food industry, are now being introduced by H. J. Heinz Company. In announcing the beginning of distribution of the new products in grocery stores, Mr. H. J. Heinz II, president, stated that the company believes that entry into glass-packed meats represents the firm's most important new product news since the firm began making baby foods in 1933. "While other companies have packed baby food meats in tin containers, never before have these products been packed in glass jars—the container preferred by an overwhelming majority of mothers," he pointed out. The company's new baby food meat products include Strained Beef, Strained Liver and Bacon, Strained Lamb, Strained Veal, Strained Liver, and Strained Beef Heart.

◆ ◆ ◆



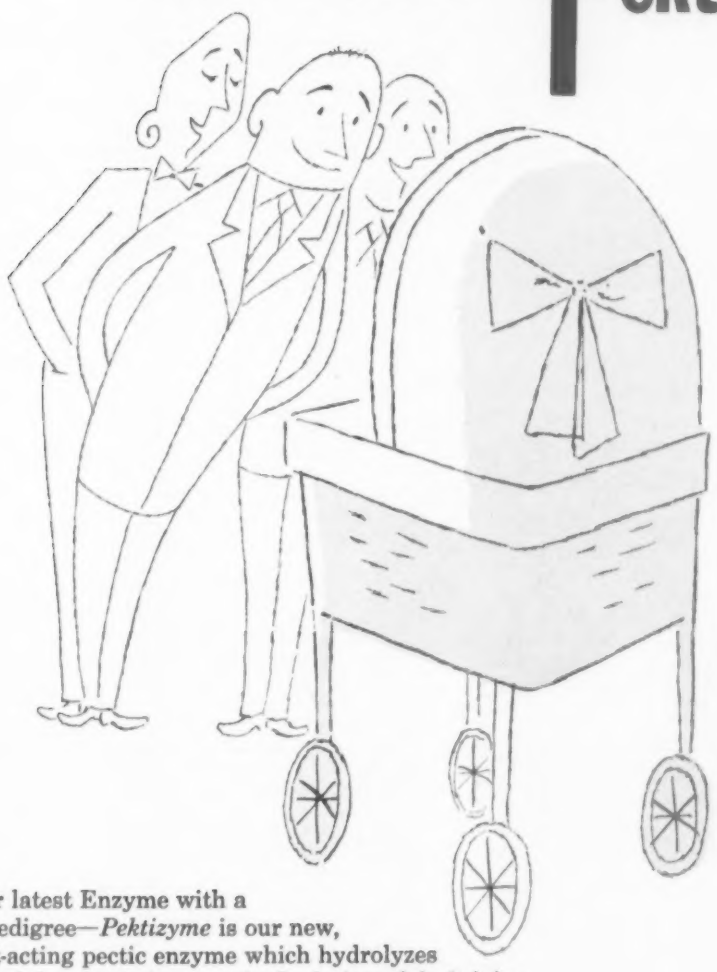
Mathieson Chemical Corp., Baltimore, Md., recently started in service the first of a series of all-steel, insulated railroad cars of advanced design for the shipment of dry ice. The cars will transport the dry ice, packaged for delivery to consumers, from Mathieson's Saltville, Va., plant, the nation's largest for manufacture of dry ice, to 15 Mathieson warehouses throughout the United States. The 54-ton car, built by Fruit Growers Express Company at Alexandria, Va., has 20% greater capacity than the standard dry ice car. Among its new features are improved insulation, roller bearings to forestall transit delays from journal failures, and a modified Duryea underframe to reduce transmission of shock to the car body.

◆ ◆ ◆

The Pennsylvania Salt Mfg. Co., 1000 Widener Bldg., Philadelphia 7, announces availability of Raydex—a new, fast, low-cost cleaner for dairy and food processing plants and equip-

(Continued on page 48)

take a peek at Pektizyme



Our latest Enzyme with a pedigree—*Pektizyme* is our new, fast-acting pectic enzyme which hydrolyzes and depolymerizes pectin. In fruit and fruit juice processing it promotes:

SPEED OF FILTRATION—by destroying the protective action of colloidal pectins and accelerating the precipitation of insoluble materials.

SPEED OF CLARIFICATION—by inducing rapid sedimentation of the insolubles.

REDUCTION OF VISCOSITY—to increase yields by facilitating the pressing of fruits; and to prevent gelation of juice concentrates.

Pektizyme also imparts a *selling personality* to apple and grape juices by giving them the brilliance, clarity and polish that consumers prefer—without affecting the flavor and bouquet of the juice.

Write for full information today.

TAKAMINE

TAKAMINE LABORATORY, INC.

CLIFTON, NEW JERSEY

Other Takamine Enzymes: Various types of starch digesting (amylases) and protein degrading (proteinases) enzymes for use under all conditions of pH and temperature. Also, glucose-oxidase for removal of glucose or oxygen from food, beverage or industrial products.

Sustane® Six

A NEW

UNIVERSAL ANTIOXIDANT

Containing BHA* and BHT*

Universal Oil Products Company offers a new antioxidant—Sustane Six—formulated with *BUTYLATED HYDROXYANISOLE and *BUTYLATED HYDROXYTOLUENE to give fats, oils, and foods superior protection against rancidity caused by oxidative deterioration.

Sustane Six gives you these advantages:

- **Greater stability**
- **More carry through**
- **Complete and ready solubility in fats and oils**
- **No product discoloration**
- **Lower cost per pound of stabilized product**

No antioxidant or combination of other antioxidants provides equivalent protection in the approved concentrations.

You can make a more stable product with Sustane Six. Write today for a sample.

PRODUCTS DEPT.

UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILL., U. S. A.

UOP®

FOOD INDUSTRY TOPICS

(Continued from page 46)

ment. A granular alkaline formulation, Raydex is a 100% active cleaner designed for heavy-duty service in hard or soft water using either brush or spray method. It contains no inert material, filler, or water. Completely free of abrasives on insolubles, Raydex is easy on equipment, will not mar polished surfaces, and may also be used to clean plant floors and woodwork. Since its alkalies are buffered for mildness, this cleaner is non-injurious to the skin. Produced in Pennsalt's Wyandotte, Mich., plant, non-caking Raydex is available in full-opening, fiber drums containing 125 and 350 pounds. Information, quotations, and the services of Pennsalt field technicians are available in all locations and may be obtained by writing to the B-K Department at the above address.

◆ ◆ ◆

A redesigned Heavy Duty Solution Balance is offered by the Ohaus Scale Corp., 1050 Commerce Ave., Union, N. J. Among new features are (1) addition of a graduated end reading dial, which enables the user to obtain a balancing position in a matter of seconds and eliminates the danger of any parallax errors; and (2) a newly developed high strength, lightweight aluminum alloy beam which reduces the inherent beam load, thereby increasing the sensitivity and life of the balance. Weighing platform and relief etched beams are of stainless steel, making them ideal for use in laboratories where corrosion is a factor. Accessories include a galvanized subject box for the weighing of animals and a seamless brass scoop and counterweight for use in weighing powders, grains, etc.

. . . *the literary corner*

Because of **sorbitol's** increasing use in processed foods, the Atlas Powder Co., Wilmington, Del., has prepared a leaflet to describe its characteristics and functions in food applications. Copies of the statement are being distributed by the Food and Drug Administration to their field offices, and they have advised that they have no objection either to the statement or to its dissemination to food processors having an interest in sorbitol. Ask for "Sorbitol in Foods—a Statement of Some Basic Considerations."

◆ ◆ ◆

The March issue of *Armour's Analysis*, published by Armour's Livestock Bureau, Chicago 9, is devoted to a report on the methods employed by ranchers to increase range production. Measures taken include the building of small dams, dikes, and terraces; improving wells, springs, and reservoirs; "pitting" the range to catch and hold surplus water; use of vegetation to conserve moisture; employment of fertilizers to improve production; and control of the rate of stocking the range.

◆ ◆ ◆

A 9-page bulletin entitled "Vacuum Forming of Celanese Acetate" prepared by the Plastics Division of Celanese Corporation of America, 180 Madison Ave., New York City 16, discusses the entire subject of vacuum packing with technical accuracy and clarity.

◆ ◆ ◆

"New Techniques for the Packaging Engineer," a publication issued by the Packaging Institute, comprising three papers on the work of the packaging engineer, is now available from Packaging Institute, 342 Madison Ave., New York City 17, at $1.25 per copy. The papers are entitled "Maintaining Proper Packaging Specifications," by Clemens Koehler of Koehler & Worden, "Quality Control Enters the Packaging Department," by A. F. Deuble of Johnson & Johnson, and "Packaging Faces the Incentive System," by S. G. Stearns, Merck & Company.

◆ ◆ ◆

Research findings on rice, recently made available by scientists of the USDA's Southern Utilization Research Branch, New Orleans, include these facts: (1) the variety of rice and environment of growth significantly influence the yields of milling, yields of the true anatomical fractions, and most of the constituents of the component parts of the grain; (2) lipids and nitrogen of the true bran, nitrogen of the white rice, and ash of the hulls will vary, depending on both variety and environment. This information is based on systematic analyses of experimentally milled fractions from rice of eight commercial varieties. The rice was grown by the Field Crops Research

Branch of the Agricultural Research Service in three locations during three crop years. These and other data appeared in *Agricultural and Food Chemistry*, Vol. 1, No. 16, 986-993, 1953, in an article entitled "Composition of Rice; Influence of Variety and Environment on Physical and Chemical Composition," by E. R. McCall and others. For free copy write Southern Regional Research Laboratory, Southern Utilization Research Branch, 2100 Robert E. Lee Blvd., New Orleans 19, La.

◆ ◆ ◆

"How to Stabilize Chocolate Syrups for Home and Fountain Use" is covered in a comprehensive way by Seaplant Chemical Corporation of New Bedford, Mass., in Technical Bulletin No. 290. The bulletin discusses the functions of stabilizers in chocolate syrups as well as giving detailed information about starting point formulas and methods of preparation. Seaplant Chemical Corporation is known throughout the food industry as a supplier of special stabilizing agents called SeaKem "Colloids Out of the Sea." Readers may secure copies of Bulletin No. 290 by writing Mr. Byron Spence, sales manager, Seaplant Chemical Corp., 63 David St., New Bedford, Mass.

◆ ◆ ◆

A new high-speed tenderizer for use in the meat market, grocery, and restaurant fields has been introduced by Sanitary Scale Co., Belvidere, Ill., and is described in Bulletin 114-A. The Sanitary Model T-2 High-Speed Tenderizer is reported to convert tough cuts of meat into tender, tempting, top-price steaks in about half the time of conventional machines. Rotary cutter action combines slitting and knitting action to tenderize properly and join the meat layers at the same time.

◆ ◆ ◆

Anyone with **sorting problems** will be interested in the very attractive and instructive brochure, "Scientific Sorting Serves Industry," available from the Electric Sorting Machine Co., 410 44th St., S. W., Grand Rapids 8, Mich. The 20-page brochure traces the general scope of the firm's past and present operations, and suggests the interesting future possibilities for ESM's products and services.

◆ ◆ ◆

Resistoflex Corp., Belleville, N. J., announces publication of a bulletin on "Fluoroflex-T" hose and hose assemblies, the com-

Journal . . . . . .

THIS JOURNAL IS PUBLISHED BY THE SOCIETY FOR APPLIED BACTERIOLOGY IN GREAT BRITAIN

of . . . . . .

IT CONTAINS ORIGINAL PAPERS AND SYMPOSIA ON ALL ASPECTS OF AGRICULTURAL AND INDUSTRIAL BACTERIOLOGY

applied . . . . . .

ONE VOLUME OF TWO NUMBERS IS PUBLISHED ANNUALLY. PRICE TO NON-MEMBERS: £2 PER VOL.; 25/- PER NO.

Bacteriology . . . .

ORDER YOUR COPY NOW FROM YOUR LOCAL BOOKSELLER OR DIRECT FROM THE PUBLICATIONS MANAGER: E. A. WHITLOCK, WALLACE & TIERNAN, LTD., POWER ROAD, LONDON, W.4, ENGLAND

BRADLEY & SON, LTD., THE CROWN PRESS, READING, ENGLAND

All Flavors look alike... put your confidence in a name you can trust!

Manufacturing flavor chemists and consultants, specializing in the creation and precision processing of flavors to fit your individual product needs and specifications.

WELCOME TO

BOOTH 67

Los Angeles Biltmore Hotel

June 27 - July 1

FOOD MATERIALS CORPORATION

2521 West 48th St., Chicago 32, Illinois

Building flavor is our business

Today's housewife "pays her money and she takes her choice." Even blindfolded, she could recognize superior flavor!

Since it's *your* business to gain preference for your brand, let's get together. Flavor builds repeat business...Ac'cent builds flavor by supplementing nature's own flavor protein derivative—glutamate—which dissipates in shipping, storage and processing.

It's no secret that many leading processors use Ac'cent—uniform crystals of monosodium glutamate in its purest, most stable form. Now, with our capacity doubled to meet increasing demand, Ac'cent achieves greater volume, greater economies. Count on Ac'cent for dependable supply!

Your Ac'cent representative can arrange a comprehensive taste test in your own plant. Call or write him and he'll be glad to work with you. Take advantage of our extensive research and development service, offered to food processors without obligation.

Ac'cent®
PURE MONOSODIUM GLUTAMATE
..builds natural food flavor!

AC'CENT INTERNATIONAL
20 NORTH WACKER DRIVE · CHICAGO 6, ILLINOIS

FOOD INDUSTRY TOPICS

pany's new plastic hose made from Teflon and engineered to withstand highly corrosive fluids from temperatures of minus 100° F. to plus 450° F. Described are test results, sizes, and construction features.

. . . *meeting hall and conference room*

Toor-a-loor-a-Leura? That may well have been the theme song of the Fourth Annual Convention of the Australian Regional Sections of the IFT, held May 26-29 at Leura, N. S. W., in the heart of the beautiful Blue Mountains region of Australia. Chairmen of the various sessions were J. F. Kefford, chairman of Australia Northern Section of IFT, who presided at the general opening program; H. G. Jessep, chairman of Australia Southern Section of IFT, presiding at the session on quality control; Associate Professor F. H. Reuter, New South Wales University of Technology, who chairmaned the session on technology and research; and F. C. Elsworth, Dewey & Almy Pty., Ltd., who presided at the symposium on packaging. Guest speaker at the official dinner was Dr. W. A. Westerman of the Australia Department of Commerce and Agriculture.

◆ ◆ ◆

Over 400 associates and guests attended a dinner-dance held at the Waldorf-Astoria's Starlight Roof, April 17, in honor of Mr. F. H. Leonhardt, chairman of the board and past president of Fritzsche Brothers, Inc., pioneer flavor house of New York City. Occasion of the celebration was Mr. Leonhardt's sixtieth anniversary with the firm. In addition to the executives and employes from both the main office and the Clifton, N. J., plant, those attending included the sales representatives and all 10-year employes from the company's nine U. S. branch offices and from its Canadian affiliate and Mexican agency. Mr. John H. Montgomery, Fritzsche president, presented Mr. Leonhardt with an oil painting of himself as a gift from the company's employes.

◆ ◆ ◆

From The Refrigeration Research Foundation, Colorado Springs, Colo., comes the news that the growth of frozen foods,

INSTITUTE MEMBERSHIP CERTIFICATES

Engraved Membership Certificates suitable for framing (11 x 8½ inches) are now available.

✦

Name and date hand written .50 each

Name and date engrossed in lettering to match certificate lettering $2.50 each

✦

INSTITUTE OF FOOD TECHNOLOGISTS
176 W. Adams St.
Chicago 3, Illinois

stemming from increasing volume and improved technology, was the discussion highlight at the recent NAFFP meeting. Those attending were advised to anticipate a greatly expanded demand for home freezer space which will further promote the growth of frozen foods. The insistence of the consumer upon quality was also stressed to the food processors.

◆ ◆ ◆

Mr. William Lakritz, president of Florasynth Laboratories, Inc., announces that the company will as usual participate actively in the Los Angeles Annual Meeting of the IFT. All are invited to visit and participate in the activities at the Florasynth booths—numbers 41 and 42. The company will also maintain a suite in the Biltmore Hotel, site of the meeting. Executive, research, and sales personnel from the various offices of the flavor firm will assist in advising or discussing various materials, ingredients, and production problems without obligation.

. . . *the human element*

Mr. Seymour Weinstein has been appointed technical director of Niagara Filters Division, American Machine and Metals, Inc., East Moline, Ill., according to an announcement by Mr. P. S. Mumford, vice president and general manager. Mr. Weinstein, an IFT member, was formerly central district sales manager for Niagara with headquarters in Chicago. **Mr. J. Walter Bird** will take over Niagara Filters sales representation in the Chicago area and will also continue as Chicago sales representative of the Tolhurst Centrifugals Division of American Machine and Metals.

◆ ◆ ◆

Mr. Robert B. Magnus, vice president of the international essential oil firm of Magnus, Mabee & Reynard, Inc., New York City, has been elected a trustee of the Columbia University College of Pharmacy of the City of New York in recognition

(Continued on page 54)

SANITATION
starts with
IN-PLANT CHLORINATION

From start to finish of your processing operation, *Wallace & Tiernan In-Plant Chlorination* will keep your sanitation problems to a minimum by:

Eliminating slime formation on equipment and in work areas

Retarding bacteria growth

Greatly reducing offensive odors

For information on how In-Plant Chlorination can help solve *your* sanitation problems, write today to our Foods Division.

WALLACE & TIERNAN
INCORPORATED
25 MAIN STREET BELLEVILLE 9, N. J.

I-46

pH readings on-the-spot

with the Analytical pocket pH meter and revolutionary pH probe unit

Strips pH determinations of all complications

Provides simple, modern way of measuring pH accurately in field or laboratory.

Makes it easy for untrained, unskilled persons to learn to make pH readings.

Eliminates errors due to sampling techniques, turbidity, and presence of oxidizing or reducing agents.

inexpensive **$125.00**

Analytical Measurements, Inc.
585 Main Street, Chatham, N. J.

Instrument size: 3 x 5⅞ x 2½ inches
Case size: 3¾ x 6½ x 4⅛ inches
Weight with accessories: 3 lbs.

Completely self-contained in waterproof ever-ready case with shoulder strap.

Eliminates supports and beakers by combining the calomel and glass electrodes with the sample holder, in a single polyethylene probe unit.

Permits continuous, direct reading of pH with no buttons to hold down or dials to turn.

Analytical Measurements, Inc.
585 Main Street, Chatham, N. J.

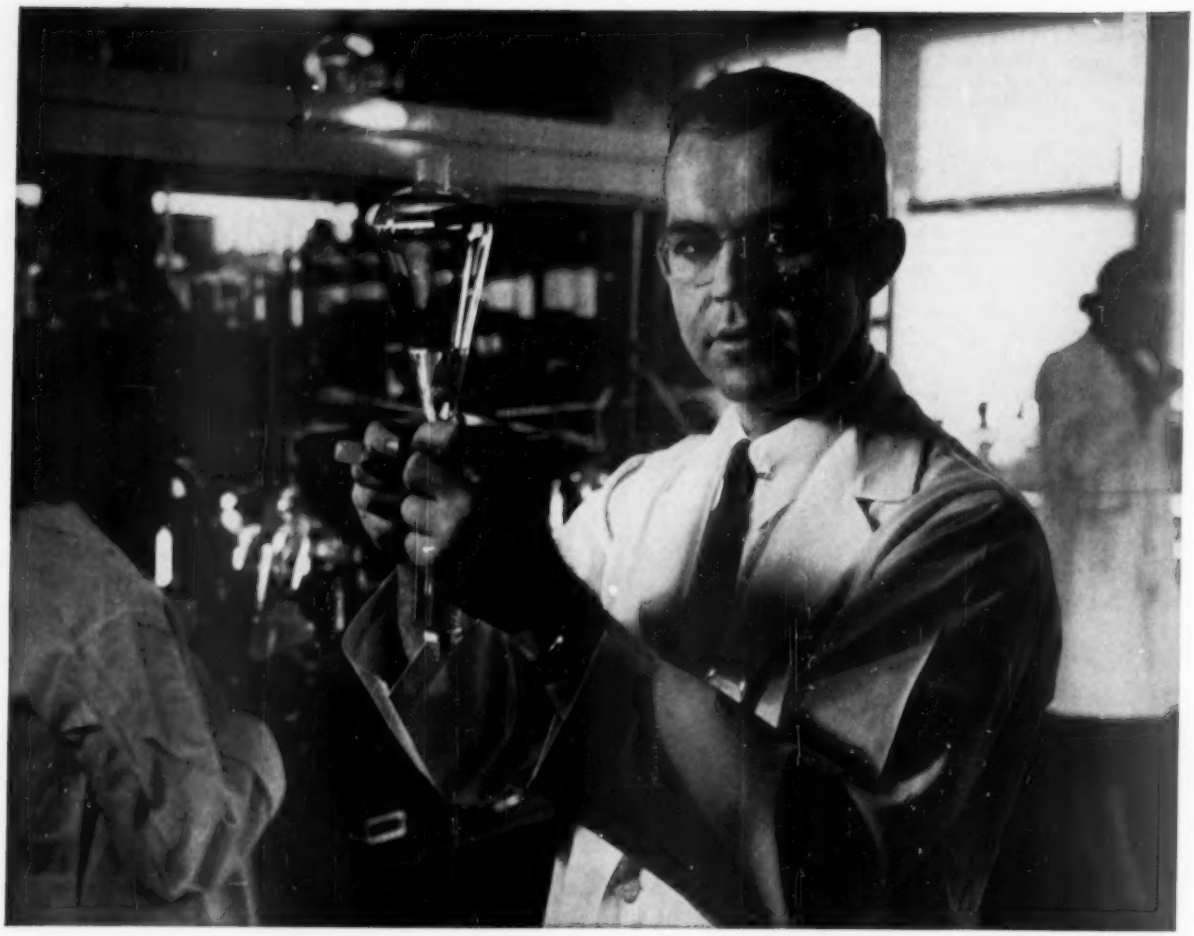
Please send full information about your pocket pH meter to:

Name _____

Company _____

Address _____

City _____ State _____



PHOTOGRAPH BY RICHARD BEATTIE

What we still don't know about cancer

—and one of the reasons why

IN THE PAST FEW YEARS, our knowledge of the nature of cancer, and how to treat it, has grown encouragingly. Patients, who would have been considered hopeless cases even five years ago, today are being completely cured. And even those who apply for treatment too late can usually live longer—and less painfully—because of modern palliative treatment.

All the same, there have been defeats as well as victories. We do not know—to take a single example—why so many more men are now dying from cancer of the lung. In 1933—just twenty years ago—lung cancer killed 2,252 men; in 1953, some 18,500. That's a great increase—which even our expanded population, and other known factors, can't possibly account for in full.

Well, why haven't we found more of the answers to cancer?

Not only because cancer is an immensely complex problem: difficult to diagnose, and difficult to treat; challenging to the best research minds.

All that is true enough. But there is another reason: *we do not* have enough money.

Last year your gifts to the American Cancer Society were more generous than ever before. But they were not enough.

You gave the Society almost twenty millions to fight a disease that—at present death rates—will kill twenty-three million living Americans.

Less than one dollar for each American destined to die from cancer. Much more is needed for research, for education, for clinics. Won't you please do *your* part . . . now?

American Cancer Society

Cancer
Man's cruelest enemy
strike back
Give

GENTLEMEN:

☐ Please send me free information on cancer.

☐ Enclosed is my contribution of $..... to the cancer crusade.

Name.....

Address.....

City.....State.....

Simply address the envelope:
CANCER c/o Postmaster, Name of Your Town

Advertisers' Index

	Page
Abbott Laboratories	6 and 7
American Can Company	2 and 3
American Cancer Society	52
American Optical Company	53
Analytical Measurements, Inc.	51
Ass'n of American Soap & Glycerine Producers	38
Bradley & Son, Ltd.	49
Continental Can Company	32 and 33
Diamond Crystal Salt Company	44
Distillation Products Industries	8 and 9
Dodge & Olcott, Inc.	19
Felton Chemical Company, Inc.	23
Firmenich, Inc.	2nd cover
Florasynth Laboratories, Inc.	39
Food Development Laboratory	54
Food Machinery & Chemical Corp.	43
Food Materials Corporation	49
Food Research Laboratories, Inc.	54
Fritzsche Brothers, Inc.	31
Givaudan Flavors, Inc.	36
Griffith Laboratories, Inc.	15
Hoffmann-La Roche, Inc.	1
Huron Milling Company	53
International Minerals & Chemical Corp.	50
Klenzade Products Inc.	34
H. Kohnstamm & Company, Inc.	17
LaWall & Harrisson	54
Magnus, Mabee & Reynard, Inc.	28
Merck & Company, Inc.	37
Merory Flavors, Inc.	35
Minneapolis-Honeywell Regulator Company	24 and 25
Monsanto Chemical Company	13
Norda Essential Oil & Chemical	4th cover
The Pfaudler Company	27
Chas. Pfizer & Company, Inc.	20 and 21
Polak's Frutal Works	46
Polak & Schwarz, Inc.	42
F. Ritter & Company	4
Schwarz Laboratories, Inc.	54
Seaplant Chemical Corp.	40
A. E. Staley Mfg. Co.	45
Sterwin Chemicals, Inc.	11
Takamine Laboratory, Inc.	47
John I. Thompson & Company	54
Ungerer & Company	29
Universal Oil Products Company	48
U. S. Stoneware Company	41
van Ameringen-Haebler, Inc.	3rd cover
Wallace & Tiernan Company, Inc.	51
Wisconsin Alumni Research Foundation	54

RECIPE FOR SALES

• Take a fine quick-frozen product like Swanson's Chicken Pie. Be sure MSG is in the formula . . . then watch sales go up when people taste that "down-home" flavor! Works wonders for prepared canned and frozen foods. Huron's Technical Service will be glad to help you get extra sales through extra flavor. Write Huron Milling Co., 9 Park Place, New York City 7.

HURON MSG

PURE MONOSODIUM GLUTAMATE 99+%

Made by the pioneers in protein derivatives

AO LABORATORY MICROSCOPES

Feature after feature for superior performance, easier manipulation, permanent satisfaction:

CUSTOM TENSION — Substage and coarse adjustments may be set to your touch.

"PINCH GRIP" STAGE — Permits slides to be interchanged without disturbing stage settings.

"AUTOFOCUS" STOP — Facilitates study of slides of similar thickness in rapid succession, reduces slide breakage, prevents rocking objectives into condenser.

ALL CONTROLS AT FINGERTIPS — Fine adjustment closer to stage and substage controls. Dual knobs separated for finger clearance.

MICROMETER-SCREW FINE ADJUSTMENT — "Spring-loaded" to eliminate back-lash. Smooth, long-wearing ball-bearing slideways.

AMERICOTE OPTICS — (Optional), Reduce internal reflections and improve image contrast.

BUILT-IN ILLUMINATION — Eliminates adjustment. Uniformly fills the field at all powers.

CHOOSE AO INSTRUMENTS to simplify your job of guarding food quality

DIRECT RESULT COLORIMETER

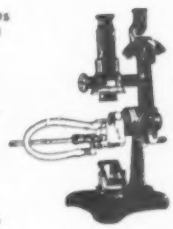
For tests where color density indicates composition quantitatively.

P45 POLARIZING MICROSCOPE

A capable polarizing instrument with the same time-saving features as the No. 78 Microscope.

TIME-SAVING NO. 78 MICROSCOPE

The simplified microscope for speedier focusing and manipulation provides more comfortable working position. The ideal routine instrument.



AO SPENCER REFRACTOMETER

To determine total dissolved solids by measuring refractive index.

AO SPENCER STEREOSCOPIC MICROSCOPES

Thoroughly proven. Thousands used in industrial laboratories everywhere. They simplify identification and counting of adulterants, etc.

DARKFIELD QUEBEC COLONY COUNTER

For estimating the bacterial concentration in dairy products.

For YOUR laboratory, be sure to specify AO Spencer Microscopes, Illuminators, Colony Counters, and other Scientific Instruments. We will gladly supply literature or assistance on inspection problems. Write Dept. I-190

American Optical
INSTRUMENT DIVISION
BUFFALO 15, NEW YORK

FOOD INDUSTRY TOPICS

(Continued from page 51)

of his lifelong interest in the profession of pharmacy and related fields.

◆ ◆ ◆

The Clissold Publishing Company announces appointment of **Mr. Charles Walter York** as editor of *The Canner*. A graduate in agricultural education from Pennsylvania State University, Mr. York has been active in educational and pro-

motional work within the canning and allied industries for the past 12 years. He is a member of the Philadelphia Public Relations Assn., the Pennsylvania Chamber of Commerce, the Council on Education, and is editor of the *Pennsylvania Packer*.

◆ ◆ ◆

Foster D. Snell, Inc., New York City firm of consulting chemists and engineers, announces the promotion of **Mr. Dan Schoenholz** to director of the Product Development Department. He will be in charge of product development, applied research and testing in the fields of paints, waxes, varnishes, polishes, inks, adhesives, and chemical specialties. Other activities of the department include examination and evaluation of raw materials, development of new test methods, plant investigations, and performance testing. **Mr. Bernard Berkeley** has been appointed assistant director.

Mr. Michael J. Curry has been elevated to the post of director of the Application Laboratory of the Chemical Division of Celanese Corporation of America. He will be in charge of application research and technical service programs assigned to the laboratory, located at Summit, N. J.

◆ ◆ ◆

Mr. Linwood C. Yates has been appointed secretary of the Tomato Council, Inc., Mr. William R. Edwards, president, has announced. The new secretary will serve at the national headquarters which will be located at Centreville, Md. Mr. Yates has had extensive administrative experience with the Maryland National Guard and has headed his own real estate brokerage firm in Centreville, Md. The Tomato Council is an association of tomato canners formed in 1953 to increase sales and promotion of canned tomatoes and tomato products.

EMPLOYMENT NOTICES

WANTED—RESEARCH CHEMIST: Natural products, bio-organic. Industrial position supplying food processing field. Require imagination and initiative. Salary open. Our employees have been informed of this ad. REPLY BOX 329, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

WANTED: TWO REPRESENTATIVES to handle bulk product sales for national organization having headquarters in central New York State. Must be willing to travel assigned territory. ONE to contact meat packers and processors. ONE to contact food processing, baking and dairy industries.

Should have good educational background and some field experience. Must be aggressive with keen interest in developing new product sales. Salary and expenses paid, excellent group benefits. Submit resumé which will be treated confidential. REPLY BOX 328, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

FOOD CHEMIST AND TECHNOLOGIST: Excellent opportunity in laboratory of Western New York State canning and freezing company. This position offers a real challenge to a man interested in making a career for himself in the food field. Prefer young man not over 30. Work to start June 1st when construction of new laboratory will be completed. REPLY BOX 326, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

AVAILABLE: Food Technologist, Fifteen years experience, Research in sterilization, microbiology and nutrition. Experienced in applications of complex phosphates in food processing, especially in cured meats. At present employed. REPLY BOX 331, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

POSITION WANTED: Biochemist and Chemist with 19 years experience in control, development and research on foods and food products, desires position in research utilizing experience. Knows Nutrition, Analysis, Fats and Oils, Supervision. Location immaterial. REPLY BOX 332, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

WANTED—TECHNICAL SALES REPRESENTATIVE. To assist ingredient salesmen with technical advice in food processing field, also do new product development work on preserved and canned foods. Salary open. Our employees have been informed of this ad. REPLY BOX 330, Institute of Food Technologists, 176 W. Adams St., Chicago 3, Ill.

AVAILABLE: Food Technologist, Ph.D. Recent graduate with training in Food Technology, Horticulture, Bacteriology, Biochemistry and Statistics, with experience in industry and research. Desires position in research and development or Quality Control. Prefer employment anywhere outside U. S. REPLY P. O. Box 151, Mombasa, Kenya, East Africa.

Mechanical - Management - Electronic
Process - Design - Quality Control
Investigations - Appraisals - Reports
JOHN I. THOMPSON & CO.
ENGINEERS
921 17th St., N.W. Wash'ton 6, D. C.
Laboratory Division: Bellefonte, Pa.

WISCONSIN ALUMNI RESEARCH FOUNDATION
PRODUCTION CONTROL SERVICES
Vitamin D rat assay – results in 8 to 10 days • U.S.P. XIV or A.O.A.C. vitamin A assays • Other vitamin assays • Antibiotic and amino acid assays • Sodium Determinations • Proximate analyses and mineral determinations. Pharmacology including warm-blooded toxicity studies • Specific immune sera • Enzyme investigations • Other biological, chemical, and microbiological services.
Project Research and Consultation
WISCONSIN ALUMNI RESEARCH FOUNDATION
P.O. Box 2059-S • Madison 1, Wis.

Food Development Laboratory
S. W. ARENSON, DIRECTOR
Proof service to the baking and potato chip industries. Ingredient evaluations. New product development. Baking, frying, spray drying equipment. Chemical and physical testing facilities.
2865 W. Franklin St. Baltimore 23, Md.
440 W. 24th Street New York, N. Y.

FOOD RESEARCH LABORATORIES, INC.
Founded 1922
Philip B. Hawk, Ph.D., President
Bernard L. Oser, Ph.D., Director
Research • Analyses • Consultation
ORGANOLEPTIC PANEL TESTING
Biological, Nutritional, Toxicological Studies for the Food, Drug and Allied Industries
48-14 33rd Street, Long Island City 1, N.Y.

Food Ingredient & New Drug Studies
DIGITALIS ASSAYS
Bacteriologists Chemists Pharmacologists
LaWall & Harrisson
Dir. F, 1921 Walnut St., Philadelphia 3, Pa.
ANALYSES CONSULTATION RESEARCH

Schwarz
SERVICES TO THE FOOD INDUSTRIES
• Consultation on Food Problems.
• Analyses of food materials and products.
• Food plant design, process examination and control.
• Legal testimony and consultation on government regulations.
Founded 1867
Write for bulletin "Scientific Quality Control of Foods and Beverages"
SCHWARZ LABORATORIES, Inc.
230 Washington St., Mount Vernon, N. Y.

Sealva*

THE NEW HERMETICALLY SEALED **FLAVORS**

Success

The unusual success of the remarkable SEALVA* process is attested to by its wide acceptance in almost every branch of the food field. Already SEALVA flavors are being used in commercial production in—

- **Pie Fillings**
- **Cake Mixes**
- **Cake Icing Mixes**
- **Pudding Powders**
- **Gelatin Desserts**
- **Ice Cream & Sherbet Mixes**
- **Confectionery Cream Centers**
- **Pressed Wafers**
- **Chewing Gum**
- **Pharmaceuticals**
- **Summer Drink Powders**

SEALVA flavors can undoubtedly improve the taste and acceptance of your product. Samples and technical data at your request.

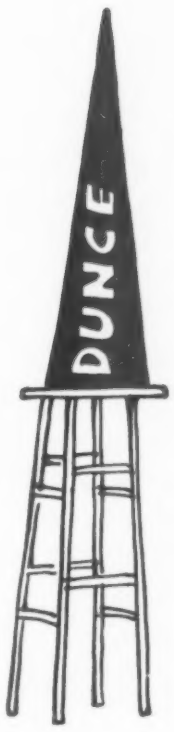
VAN AMERINGEN-HAEBLER, INC.

521 WEST 57th STREET • NEW YORK 19, N. Y.

Alva FLAVORS

* The SEALVA process is a method whereby minute droplets of flavor oils are sealed against the ravages of atmosphere and shelf-life within an impermeable membrane of edible gum. The flavor contained in this dry powdered form is released instantly in the mouth or in liquids.

When Nature Hasn't Played Fair with a Grape



You sometimes have to give Nature a boost, for the sake of your own pocketbook. That's when Norda can be a big help.

Here's how it works:

You use Norda genuine natural fruit Flavors, because they give your products real true-fruit taste. They're rich and wonderful.

Maybe, though, it's not profitable to use *all* natural fruit flavors. Then "piece them out" and supplement them with Norda imitation Flavors. They have the same fine characteristics. They're full-bodied, true to type, almost indistinguishable from the genuine. You can economize with them, without skimping on strength or quality.

Norda Grape Flavor will show you. Let us send you *free* samples of both genuine and imitation. Send your request today.

–Come to Norda

Use a Norda "Favorite to Flavor It"

Norda

Norda, Inc., 601 West 26th Street, New York 1, N. Y.

Chicago • Los Angeles • San Francisco • Montreal • Toronto • Havana • London • Paris • Grasse • Mexico City